RELATIONSHIP OF INTELLECTUAL DEVELOPMENT WITH CREATIVITY, ACHIEVEMENT AND SOCIO-ECONOMIC STATUS OF XI GRADE SCIENCE STUDENTS

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DECLARATION BY THE INVESTIGATOR

I here by declare that the thesis " Relationship of Intellectual Development with creativity Achievement and Socio- economics status of XI grade Science Students", which is being Submitted to the faculty of Education, Jamia Millia Islamia, New Delhi, in the fulfilment of the reqirement for the degree of Doctor of Philosophy (Education), has not previously formed the basis for the award of any degree, Diploma, associateship or other smilar title or recognition.

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I hereby certify that the thesis of Shri Santosh Kumar, entitled 'Relationship of Intellectual Development with Creativity Achievement and Socio-economic status of XI grade Science students' is a record of bonafide research carried out by him under my guidance and supervision.

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CHAPTER I

PROBLEM AND ITS SIGNIFICANCE

INTRODUCTION

During the past three decades two major areas of educational and psychological research, namely, the work of Piaget on the development of the intellect and Guilford's study of creativity have come into prominence. Piagetian theory has provided a broad framework of the development of reasoning as also the factors which might affect the development of the same (Piaget, 1972; Renner and Stafford; 1972). The study of creativity has illuminated facts of the creative person, creative process, and creative product (Gowen, 1972; Reweton , 1973). Both areas, because of their apparent intrinsic value in education, have received greater attention today from academicians, than in the past.

However, this attention has often been witnessed in two ways. Firstly, those who support Piaget's theory have generally stressed the need to help students to develop the power of reasoning and skills necessary for adequate understanding of science (Nordland,et.al; 1974; Lawson 1975; Chiapetta 1976). In contrast the other group of researchers namely Getbels and Jackson, 1962, Wallach and Kogan, 1965; Gave 1970; the proponents of

creativity have laid more emphasis on the need for divergent thinking (Guilford, 1959) and even irrational thinking (Torrance and Myers, 1974). This diversity of stress pertaining to the intellectual development and creativity during the span of individual growth calls for bridging the gap, research efforts for which have not so far made any headway. The present piece of reasearch seeks to explore such a possibility.

INTELLECTUAL DEVELOPMENT OF THE CHILD

The invention and refinement of intelligence tests in England, France and United States yielded useful quantitative indices of intellectual status. When norms are available, a child's development can be compared, in a general way, whth the development of other. But there were always some reasearchers, including Binet himself, who sought more than a general quantitative index.

Jean Piaget was one who rejected the quantitative measures for a more qualitative approach. In the year 1920, he initiated a long term programme to chart the stages of child's progress toward adult model of thoughts. Although the questions he raised and his reasearch style 'Methods Clinique' were unfamiliar, he eventually won a wide audience in both psychological and educational

circles. His unorthodox claims about the cognitive scheme that the child constructs and thinks through which he knows that the world could no longer be ignored are now in fact being integrated with the more familiar notions.

Piaget, who believes that cognitive development proceeds in a fixed orderly sequence and that throught processes of children are very different from the thought processes of adults, has had a great impact on our understanding of mental development. In defining intelligence, most of the test users and psychologists who have constructed intelligence tests lay stress on the ability to think in abstract terms and to reason together with the ability to use their functions for adaptive purposes. Piaget regards intelligence as a specific instance of adaptive behaviour, of coping with environment and organizing (and reorganizing) thoughts and actions. In other words, for Piaget, in intelligence is the ability to adapt oto environment and to new situations, to think and act in adaptive ways. Piaget's work focussed on qualitative descriptions of the changes that occur as the child's cognitive abilities mature.

Piag et, first of all defines intellegence as the

ability to adapt to the environment. Adaptation takes place through assimilation and through accomodation, with the two processes interacting throughout life in different ways. In assimilation the individual absorbs new information, fitting features of the environment into internal cognitive structure. In accommodation the individual modifies these internal cognitive structures to confirm to the new information and meet the demands of the environment. A balance is ... through equilibration, as the individual organizes the demand of the environment in terms of previously existing cognitive structure. Equilibration is an active process that involves constant interaction between the individual and the environment and also establishes a balance between assimilation and accommodation.

Piaget has an empirical epistemology that is to be approached developmentally. He has not considered the world to be real but has studied the changing processes by which the growing child copes with the world. His accounts of development are not different from those of strict environmentalists. However, many of his concepts such as assimilation and adaptation are biological in nature.

Piaget's Philosophy of Development

Piaget sees a biological organization as an open system which extends into the environment, but which at the same time must close in order to present its own organization. Behaviour is a kind of resultant of this double function. Concepts related to the Piagetian thinking are explained below

Knowing : Knowing is an evolutionary advance which tends towards stabilizing this oscillation between opening and closing. Through knowing the biological organization tends to reach beyond itself, Hence Piaget's epistemological search leads him to look at this biological organization. To Piaget cognitive functions constitute a specialized organ which regulates the interaction of the organism with its environment but are derived from a 'general biological organization'.

Since, for Piaget, knowing is a biological phenomenon the attainment of truth is also a biological urge because it is a characteristic of knowledge to attain truth. Truth is not merelly a copy of external reality (and failure to realize this has led to philosophical error), but it is rather an organization of the real.

Knowledge : Knowledge, Piaget says, is of three main

kinds (i) innate know-how or instinct, (ii) knowledge of the external world through the sense organs, and (iii) logico-mathematical knowledge. For Piaget the instincts involve cognitive regulation but these are preprogrammed and rigid.

The third kind of knowledge is a late evolutionary innovation. For Piaget, instincts almost totally disappear in primates, but the new mode of knowledge does not replace instinct rather, it disassociates instinct and uses its components. Instinct is not exclusively preprogrammed. He recognizes that it is a basis for further modes of organizations.

Piaget's concern was largely with the knowledge of cognition, with cognizance. In two of his last works, 'The Grasp of Consciousness' (1976) and 'Successes and Understanding' (1978), he distinguished between a practical form of knowledge that arose from successful solution of a problem and true understanding that involves full awareness, or consicousness of that action. This true understanding the progression from the practical form of knowledge to thought was effected by cognizance. This cognizance, in Piaget's view, does not emerge fully until age 11-12 years. He applied strong criteria to the identification of a subject's consciousness or cognizance in a problem solving situation. In general when a

psychologist speaks of a subject being conscious of a situation he means that the subject is fully aware of his environment.

The theory of Piaget concerning the developmental evolution of intelligence does not rest on theories of learning based on the stimulus-response model. In between the stimulus-responses, there exists the organism and its structures. But as Apostel (1959) has indicated it would be possible to integrate Piaget's theory in this cadre by means of what may appear to be the objectives of the processes of learning the scheme. In Piaget's work, a scheme of action is established either by a series of reactions or by a sequence of reactions and events. It may be, for example, a simple reflex action or a complex behavious pattern in problem solving. The scheme is transformed by assimilation and accommodation. This transformation answers to the definition of learning. In effect, confronted by new objects schemes of action which are already functional can be either assimilated, or modified by adjusting to the new situation.

Piaget, the chief advocate of the Geneva School of thought has been influenced in thinking and work by Plato's rationalistic tradition, work of Gestalt Psychology, use of logic for interpretation of thinking (classes, relations, grasping, or reversibility and equilibrium)

and several individual personalities of past and present of his country (Irene, 1970). He used successfully various techniques of symbolic logic for uncovering the intellectual behaviour of young childern's thought and the use of search symbolic logic (components). Piaget was able to discuss the properties of thinking (process) at various age levels in terms of what 'operations' childern within the age group are capable and incapable of performing.

Piaget has been concerned with the structure and working of adult mind, and how it got that way. Piaget created a new vocabulary rather than constructed neologisms. However, Piaget has done two things, first he used existing words with slightly modified meanings, and secondly, used the technical vocabulary of symbolic logic. His reason for employing symbolic logic in that language of this discipline provides good way of describing such the structure of intellect as Euclidean geometry is ideal for describing plane surface and riemanian geometry for sphere.

Operation : The word 'operation' seems to have been derived from 'action'. Operation plays an important part in logic which is based on abstract algebra and is made up of symbolic manipulations. Operation in the

Piagetian sense is a mental action within the person. It modifies the object of knowledge and renders the individual capable of understanding the structure of the transformation that has come. He has, therefore, attempted to develop a psychological theory of operations which links psychology to logic. Since an internalized action is an operation and thus according to Piaget the development of the intellect consists in the growth of operational thinking.

Psychologically, operations are actions which are internalizable, reversible, and co-ordinated into a system characterised by laws which apply to the system as a whole. They are actions since they are carried out on objects before being performed on symbols. They are internalizable, since they can also be carried out in thought without losing their original character of actions. They are reversible as against simple actions which are irreversible. In this way, the operation of combining can be inverted immediately into the operation of dissociation...........Finally, since operations do not exist in isolation, they are connected in the form of structured or wholes (Piaget and Inhelder, 1961).

Here operations are considered real psychological activities on which our whole effective and real knowledge

is based. Roughly speaking, operation is a means for "mentally transforming data about the real world", so that they can later on be organized and used selectively in problem solving. Operation is internalized and reversible and this distinguishes itself from a simple action or goal directed behaviour. Properties of an operation can be summarized as follows:

(i) The operation is reversible, it can function in opposite directions; (ii) A operation never takes place in isolation, it is always linked to another system, object or scheme; (iii) The operation is always a part of a structure and ensemble. The correct role of operations is to form system, which are groupings in the case of qualitative systems (simple classifications, double entry tables, serialized relationships) or groups when it is a matter of spatial, temporal, algebraic, geometric and topological structures; and (iv) the comprehensive systems developed according to a certain number of chronological stages developing in a constant order.

PIAGET'S STAGES OF INTELLECTUAL DEVELOPMENT

Like Vyogostky and Bruner, Piaget also propounded the stages of the constructions of the operations. Perhaps Piaget's most notable and significant contribution

to contemporary educational thought and practice has been characterization of specific intellectual developmental stages of childern. Within this developmental process, he locates a series of distinct developmental phases and sub-phases. Each distinct sub-phase within any one of his major developmental phase has been classified by Piaget and co-workers as sub-stages of development. Piaget has divided the period of intellectual development into four major developmental stages which serve as a convenient handle for presentation of the intellectual development. Each stage reflects a range of organizational patterns which occur in a definite sequence within an approximate age span (of that stage) in continuance of development. The completion of one stage provides a self regulation, as well as the beginning of assimilation, for a new stage.

The stage concept is linked to the idea of mental structure. In a stage, the development of anything is a set of relations prevailing at one time. Each stage can be achieved only when its precursor has been properly attained, and that if any early stage is incomplete, later stage will not be effective. Each stage suggests the potential capacity and probable level of behaviour. They provide a possible key for adopting the learner's capabilities. Piaget (1953) has identified these stages as follows: (i) the Sensory Motor Stage, (ii) the Pre-

Operational stage, (iii) the Concrete-Operational stage and (iv) the Formal Operational stage.

The Sensory Motor Stage

It is the first stage of intellectual development which lasts from birth until about 18 months to 2 years of age. Originally defined by Piaget (1953a, 1953b), this is the stage in which sensory motor preformance become progressively structured into functional systems which form the building blocks of later cognitive activity. The child's sensory-motor behaviour, while organized, is not cognitive, since it depends on responding to the stimulus as presented, rather than as represented or interpreted by cognitive activity. Thus sensory motor behaviour lacks the representational component of true cognition (Piaget, 1947). In the first half of this stage, the child's activity is centered on his own body.

In the second half the child develops schemes or scheme of practival intelligence which enables him to deal with objects in space. The child is highly dependent upon his parents for satisfaction of physical needs; performs only overt activities, thinks least about his actions, is attracted mostly by sound, touch and other physical stimuli, the most basic intellectual accomplishment of the ability to recognise objects.

The Preoperational Stage

Preoperational thought is a sub-period of concrete operations. It extends from two to about six or seven years and is characterized by the rapid development of representational or semiotic functions, which Piaget considers to develop during the pre-operational period imitation, play, drawing, mental image, memory and language The child at this stage is restricted to recognizing functional relations, has difficulty in distinguishing the general from the particular, and his reasoning is pre-causal and pre-logical. Much of preoperational behaviour is defined by absence of concrete-operational achievements like, seriation, classification, conservation, transitivity and spatial and geometrical concepts.

The preoperational stage is a tune of free play and imagination. It is, therefore, important that teachers of primary classes provide opportunities for the children to engage in plays of preceptive nature, using all of their sense to explore and observe the physical world. In science activities, the teacher should be more concerned with having the children touch, taste, smell, listen and watch than with discussing these experiences at any length (Anderson, et.al, 1970).

The Concrete Operational Stage

The period of concrete operations is that level of

development in which the child uses intellectual operations based on internalized intellectual structures to classify concrete objects and/or events. The concrete period, including the subperiod of preoperational thought, extends from 7 to 11 years of age. The development of concrete-operational thinking at this age enables the child to solve problems and to develop understanding of class, relations and quantity of objects and encounter with his environment. Although the thinking of the child is still concrete, that is largely limited to the physical manipulation of objects rather than symbols, he can now perform elementary logical operations, for example classification, serialization, time and space relationship, idea on number etc. According to Piaget, the child is only capable of reacting beyond the simple observations of facts which he has at his disposal, suitable schemes of operation that allow him to stabilize relationship with them. It seems that this stage is covered in two distinct parts;

Stage A (7 to 8 years) : This is the stage in which the child succeeds in mainipulating of certain concrete operationas (class, relationship, number and space) and of the first relations, conservation, and transitivity etc.

Stage B (9 to 11 years) : Child applies serial ordering and establishes one to one correspondence between two observable sets (eg. small animals have a fast heart beat

while large animals have a slow heart beat). He begins to attack problems systematically, but cannot find mathematical proofs. He does not accept hypothetical data, reality dominates his thinking and the possibilities are subordinated to it.

The Formal Operational Stage

The stage of formal operational thinking begins to develop at around 12 to 15 years of age. The quality of formal operational thoughts differs from concrete thought in several different ways. The principal difference is that the concrete opeator is confined in his thinking to concrete objects, events or situations, while a formal thinker on the other hand, can respond to logical form of argument and deal with propositions, regardless of the specific content involved. He imagines and considers all sorts of facts, beliefs, hypotheses and possiblities. He develops the ability to reason by hypotheses and finds empirical and mathematical proofs for his observations. Inhelder and Piaget (1958) state, "The most prominent feature of formal thought is that it no longer deals with objects directly but with verbal elements ". The various reasoning patterns given by Karpulus et.al. (1977) are listed below:

F1 : Applies multiple classification, logic, serial ordering and other reasoning pattern to concepts, abstract properties,

axioms and theories.

F2 : Applies combinatonal reasoning considering all conceivable combinations.

F3 : States and interprets functional relationships in mathematical forms.

F4 : Recognise the necessity of an experimental design that controls all variables but the one being investigated.

As claimed by Piaget, the formal stage is an important and productive period of life. According to him it is the time when one plans one's future and fixes the goal of life. He believes that intelligence reaches its peak, thus thinking and reasoning are very superior in this stage.

This stage is markedly different from the previous stage by dealing with the possible versus the real. Brainerd (1978) describes this stage as hypotheto-deductive, scientific and reflective abstraction. Flavell (1963) describes it as 'a generalized orientation', some times explicit and some times implicit towards problem solving and orientation towards data (combinational analysis), towards isolation and control of variables, towards the sypothetical and the logical justification and proof.

In the words of Inhelder and Piaget, "Formal thinking is essentially hypothetical deductive. It implies

deduction no longer refers directly to perceived realities but to hypothetical statements i.e. it refers to propositions, which are formulations of hypotheses or which are postulates/facts or events independent of whether or not they actually occur. The most distinctive property of formal thought is a reversal of the subjects method of approach. Thus this type of thinking proceeds from what is possible to what is empirical and real.

Piaget (1967) summarizes the three novelties of the formal stage as follows:

(a) There is a generalisation of classification leading to the classification of the second degree, called the 'Combinational'.

(b) This combinational allows the addition of 'propositional operations' to the operations of classes and relations. This implies a most general form of logic in which the form is independent of the content.

(c) This formal structure thus becomes completely reversible with N and R. There is then a complete group of four transformations, INRC. INRC group is a set of four operations, namely, identity, negation, reciprocity and correlation.

The age level which Piaget proposes are approximate, varying widely because of intellectual factors, experience,

training, and socio-economic status. It is obvious that children often operate on more than one level at more or less the same time, depending on the nature of the challenge. A child may, without self contradiction, operate logically in one field and not in another, or operate inconsistently in the same field at different times (Kuslan and Stone, 1968). Piaget remarks that teachers should not directly correct a child's ideas, incorrect thoughts, they may be, but should instead provide a sufficient variety of experiences to enable the child to correct himself. In this way he avoids an explanation (harmful-accommodation) which is not in accord with his own thought (Duck Worth, 1964).

Transition of Thought:

The Geneva School considers the following five transformations which marked the passage from the concrete operational level of thought to the stage of formal operation. Piaget puts these as under:

(i) The first and the most important transformation is the capacity of reasoning on hypotheses. This type of reasoning has been termed as hypothetivo-deductive;

(ii) The second transformation is the use of logic at the concrete operational level. The child is capable of reasoning which Piaget calls inter

propositional logic, that is the child has become capable of stabilizing the logical link between presage and conclusion independently;

(iii) The third transformation puts the adolescent pupils in a position to separate themselves from content which does not happen in the second transformation. Possibilities rather than reality becomes chief distinguishing characteristic of his (adolescent) thought;

(iv) The fourth transformation deals with the combinatorial nature of that is, from 16 (sixteen) binary combinatorian to 256 (two hundred fifty six) ternary operation.

(v) The system of all possible combinations from the logic of proposition whose use and mastery constitute the fifty basic transformation of the formal operational stage of thought.

All these five transformations have been derived from one single identifiable mental structure i.e. the INRC group.

C R E A T I V I T Y

The Concept

Psychological researches in the domain of thinking have revealed that there are a variety of thinking abilities and not all of them are of equal value from the point of

production of useful ideas. A type of thinking now commonly designated as divergent thinking which enables a person to think in a variety of ways and to arrive at novel solutions to problems, is considered to be of much importance for creative work. Every person is endowed with some amount of creativity in one way or the other. There are a number of theories as to how the creative process operates. In fact, there is no clear cut agreement that creativity involves the ability to produce novel or original product (Taylor, 1964).

The dictionary definition of creativity seems to present little diff culty for a clear cut understanding of the concept and in the literature of measurement it has proved to be one of the most trouble some concepts with no universally accepted definition and method for its quantitative evaluation (Tords, 1970). The definitions of creativity range from originality of thought through problem solving and inventiveness to the near non-conformity (Cattell, 1971). Generally, the most widely applied conception of creativity are formulated ther in erms of some manifested product or any underlving process. Torrance (1962) focussed on creativity as the process of sensing gaps, or disturbing missing elements forming new ideas or hypotheses concerning them, testing these hypotheses and communicating the results, possible modifying and retesting

the hypotheses. Dave (1974) focussed on creativity as the apex of all learning involving three behavioural steps i.e. analysis, synthesis and judgement, which ultimately evolves a unique production. Pires et.al. (1960) defined creativity as the capacity of the individual to avoid usual routine and conventional ways of thinking and doing things. Guilford (1956), Sultan (1962), Anderson (1964) and Taylor explained the construct through factor analy ical approach. These and other approaches to define creativity Barron, 1959; Rhodes, 1961; Simpson, 1962; Wallach and Kogan, 1965; lead one to conclude that creativity involves an action of mind directed to manipulate the environment with a view to produce new ideas, patterns, or relationships. Dave (1970) has tried to define creativity in what could be described through creativity tests measuring fluency, flexibility, originality and elaboration.

The significant and recent upsurge of interest, in creativity and creative thinking is primarily a result of Guilford's work (1956, 59, 63, 66 & 1967). Guilford's concept of creativity involves a problem solving model based on his structure of intellect. Acknowledging to convergent and divergent distinctions between ordinary intellectual system model, an interaction among memory stage, divergent operations and evaluation through the application of the factor analysis technique, Guilford has

been able to demonstrate the presence of such factors in his structure of intellect model as fluency, flexibility and originality.

Since after Guilford's work, the researches in the area of creativity have grown tremendously, so that today a wide variety of topics fall under the heading of creativity ranging from cognitive, rational and semantic elements all the way to operations.

Dimensions of Creativity

Creativity as a concept has been defined and elaborated in various ways by the concerned researchers. They have been approaching creativity through one or more of the four dimensions viz. person, process, product and press. It is e perhaps simplest and appropriate to consider the first three categories of researches on creativity, namely, the Creative Product, Creative Process, and the Creative Person.

The Creative Person

In describing the creative person, Taylor (1963) notes the importance of divergent thinking, especially in production of ideas, fluency, flexibility and originality. Humour, fantasy and playfulness with ideas are some more characteristics. Other traits mentioned include curiosity, mainpulation, questioning ability and restructuring of ideas. Personality characteristics mentioned are autonomy, independence, femininity of interests, dominance, self-

acceptance, resourcefulness, radicalness and complexity of personality.

Mackinnon (1962) has summarised the characteristic of creative persons as follows: intelligent, original, independent in thought and action, open to experience both of the inner self and the outer world, intuitive, aesthetically sensitive and free from crippling restraints. They also have high energy level, a persistent commitment to creative endeavour and a strong sense of destiny which includes a degree of resourcefulness and measure of egoticism.

Besides summarizing the characteristics of creative individuals Mackinnon (1963) feels that creative persons are typical of many who make up for what they lack in verbal intellectual giftedness with a high level of energy, a kind of cognitive flexibility which enables them to keep attacking the problem with a variety of teachniques from a variety of angles and being confident of their ultimate success, they persevere until they arrive at a creative solution. This kind of person should remind us that creative giftedness is not necessarily equated with high verbal intelligence.

The Creative Product

It is generally accepted that a product to be considered as creative must be both novel and useful. The product is judged qualitatively by the degree of its

social recognition. Another category of quality of output is number of words, ideas, sentences or other products in generalized psychological forms. Ghiselin (Taylor, 1964) says 'the measure of creative product should be the extent to which it restructures over universe of understanding'.

A product is obviously an outcome of some processes. Stein considered a process creative when it results in a novel work that is accepted as tenable or useful or satisfying by a group, at some point in time. The author clarifies and expends each part of this definition.

By 'novel' is meant deviations from the status quo. It represents a reintegration of existing materials or knowledge for the production of something new. It is a consequence of interaction between a creative individual and his environment.

In saying that the creative work is 'tenable' or 'useful' of 'satisfying' the author is covering the different areas of ideas, things and aesthetic experiences, respectively. It is stressed that the results of the creative process must be communicated to others. This implies two requisites for the creative person:

a) he must have mastered a means, or medium of communications; and

b) he must have eliminated from the creative product those elements that are completely idiosyncratic.

To say that the creative work must be accepted by some group implies that in some way it must be congruent with the needs or experiences of that group i.e. it 'resonates' with these needs or experiences. The acceptance in addition to defining the creative work, offers feedback to the creative person so that he can clarify, alter, or make progress in his future work.

In aindicating that the creative work is accepted 'at some point in time', provision is made for the fact that such products may be evaluated differently in different historical periods. While the possibility of the universals is admitted, the problems in defining them are stressed. In this regard, it is pointed out that the individual att attempting to define them is himself bound to a particular historical period and its value judgements.

The Creative Process

Definitions of creativity in terms of traits, have gradually given way to definitions of creativity in terms of the process. For example, Stein (Taylor, 1955) states three of the basic assumptions underlying the approach to the problems of creativity. They are (i) Creativity is the resultant process that occurs within the individual. In general, one tends to judge the creativity of others in terms of the production they have produced or stated differently, in terms of the distances between what they

have produced and the status of the field before they come on the scene. Such an orientation makes us overlook the fact that creativity is a process. It is a process of hypotheses formation, hypotheses testing and the communcation of results. (ii) Creativity is the resultant process of social transactions. Individuals affect and are effected by the environment in which they live. They do not interact with their environment without changes occuring in both directions. (iii) For pur oses of empirical research the difinition is as follows: Creativity is that process which results in 'a novel work that is accepted as tenable to be useful or satisfying by a group at some point of time!

This definition of creativity has already been explained under the heading 'Creative Product'.

Torrance (1962) defines creativity as 'the process of sensing gaps or disturbing missing elements, forming ideas or hypotheses concerning them, testing these hypotheses and communicating these results, possibly modifying and retesting the hypotheses.'

To Dashiell (1931) the salient characteristics of creative thought are: the sudden unexpected way in which the ideas occur to the creative individual; they occur in a related condition; and sometimes they seem to occur out of nowhere so that the creative individual regards himself as 'inspired'. Creativity does not involve merely

waiting for inspiration. Interviews with French poets and novelists indicate that they prepare themselves for their work by enriching and saturating themselves in their subject matter before turning to their work; novel and fruitful insights occur after a period of absorption. These accounts of the creative process suggest that it may be divided into four stages- preparation, incubation, illumination and verification.

Creativity is a cognitive expression which blossoms out of the affective domain of an individual's personality. In arriving at the novel response to the problem at hand, a creative individual plans varied solutions to the problem while gibing novel response, a creative individual uses he his earlier experience and is aware of the odds of success associated with his solution. Here the occurance of creative idea in a creative mind follows a well defined route, it is also contingent upon the favourableness of the environment in which the mind is working.

Cognitive Developmental View of Creativity

Piaget's theory of cognitive development has much relevance to the concept of creativity.

The very principles that Piaget defines as basic to the process of intelligence are also related to the creative process. In play, poems, and imitation in

childhood, Piaget claims that creative imagination (assimilation, a stage of spontaniety) does not diminish with age but as a result of the process of accommodation is gradually reintegrated, in intelligence, and is thereby correspondingly broadened. Piaget implies that creative imagination when integrated with accommodation can result in a product that is at once evidence of both creativity and intelligence. He described a process whereby creativity and intelligence nourish each other, and through their in interaction, produce intelligent activity at even more advance levels.

As one advances through Piaget's stages of cognitive development, it is aparent that the nature of any creative process has the potential to change remarkably. The creative process and product of a child at the sensorymotor level will obviously be much different thatof a child at a concrete or formal operational level.

Piaget (1971) considers the sudden insight that accompanies a shift in perspective from one stage of thought to another as a creative process. Brunner (1962) on the other hand, defines creativity as the occurance of 'effective-surprise' i.e. the experience of the unexpected that strikes one with wonder and astonishment in producing or comprehending a work. Duckworth (1972) describes students as 'having wonderful ideas' by marking new

connections and seeing new relationship among things already mastered.

Creativity is, therefore, associated with moving from one stage of cognitive development to another, restoring equilibrium by reorganising previously correlated elements through new set of rules.

ACADEMIC ACHIEVEVENT AND INTELECTUAL DEVELOPMENT

It is a realized fact that intelligence is not the only determinant of academic success. High academic performance or achievement is not possible in the absence of intellect but the presence of high intellect is no guarantee of high academic performance or achievement. A number of other factors which are broadly grouped into three categories may also affect academic performance to a great extent. These are describedbelow:

(i) Personal factors Under this factor we may include age, sex and health as possible influencing factors.

(ii) Socio-cultural factors Socio-economic conditions, The cultural background, environment at home and physical environment may affect academic growth.

(iii) Psychological factors Intelligence, achievement motivation, goals and aspirations.

self concept, interest, personality variables and intellectual development of the mind and creativity are important factors considered under this category.

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INTELLECTUAL DEVELOPMENT AND SOCIO-ECONOMIC STATUS

The relationship between intellectual development and socio-economic status and types of schooling has been and continues to be a controversial issue in developmental psychology. It is an issue both of theoretical and practical significance. Theoretically, it is important to ascertain the environmental factors that facilitate, intellectual development and the extent to which they

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account for unique variance in divelopmental status.

Alystne (1929) reported that environmental variables within the home correlate significantly with cognitive development. The investigation conducted by Jean Piaget have led to the recognition of the difference in the ways in which a child thinks at each stage of intellectual development. Mental to structure, intellectual development proceeds through the invariant functions of assimilation and accomodation resulting into adoptation. Assimilation refers to the process of incorporating new objects or experiences into pre-existing schemes or structures of thought. The simultaneous processes of assimilation and accomodation is adoptation which in effect is learning for attainment of a new concept According to Piaget the intellectual development of a child may be considered depending upon certain factors, prominent among these are : (i) maturation (ii) environmental experience (iii) social interaction and (iv) the function of auto-regulation.

Children may pass through the different stages of development at different rates although always in the same order. Development is accomplished through an interaction between cognitive factors and environmental factors which vary from country to country and even in a country from region to region. Generally rural environment

lacks stimulating experiences that make children think. The social system in rural environment is mostly based on interaction amongst the local people, and therefore channels of communication and network of relationship are limited. Rural environment has not yet fully benefited by technological advancement. As a result the intellectual development of the child in such social surroundings remains unblossomed.

I N   D E F E N C E   O F   T H E   S T U D Y

One of the crippling obstacles in the path of development is the fact that quantity is almost always more obvious, more visible, more conspicuous than quality. The stress on evolving the students gneenral capabilities as a formulator and solver of problem rather than his ability to serve as a depository of facts is especially important into the context of a developing country.

The thinking ability of adolescents is markedly different from those of children. Ausubel (1954) found that intellectual growth in adolescence proceeds smoothly from earlier stages unlike the physiological, personality and social development, where the development shows a sudden spurt during adolescence. Formal operational thinking gets developed during the adolescence. The thinking at this stage is sophisticated in the sense it is highly

logical and involves Hypothetico- Deductive operations, Proportional Logic and Combinatårial Systems. The adolescents tend to attack the aproblems more systematically and in an organised manner to solve them.

Science is taught in secondary schools today because of the recognised need for general scientific literacy, our dependence upon scientists and engineers and the value that we lay upon critical thought. To achieve such ends the courses in secondary school science should be regarded not as a body of content to be memorised but as opportunities for students to initiate studies that will develop understanding and thoughtful behaviour and action. The objectives of science teaching must be firmly imbibed in the educational philosophy of the democratic society. Optimum growth of each personality, the interplay of individual and group welfare, and the development of critical thought and problem solving abilities are the bases upon which the objectives of science teaching must rest.

Therefore, instead of leading a child with a certain of dead scientific facts, it is better to equip him with process information, which he can use for solving personal and social problems later in adult life. This necessitates the development of scientific skills (syntactical processes) against the conceptual ones which do not serve

either the individual or social need (Smith, 1966; Gate wood 1968; Kline, 1966).

Adolescent pupils show a wide variety of intellectual behaviours, while confronted with those problematic situation which do not require any specialised knowledge for its solution. So education for understanding and problem solving is, gradually becoming the chief goal of instruction in our times. Speaking restrictedly, the basic ideas underlying S-R theories, Gestalt psychology, Geneva school and accelerated learning and teaching have varying relevance for us in terms of learning or teaching means forming learning situations in which pupils explore the environment, invent concepts and apply them in several diverse problematic situations, them his role is to under go a fundemental change in the conduct of the present classroom teaching, the depth of focus indeterminate by itself, with the passage of time will be placed within the brackets of concept formation, problem solving (assembling included), self learning and maintainance of life long education in an increasingly loaded scientific and technological society.

The role and need of logical thinking in science learning being different from repeatable knowledge as the primary focus in the classroom to as a focus on what the students are doing cognitively (the mental

operations involved) and how feel about it.

The acquisition of formal operational schemata is of considerable importance to the science student's understanding of proportional relationship, for instance it is embedded in numorous physical and biological concepts and principles such as gravitational accelerating air pressure, the chemical law of definite composition and diffusion. Combinational reasoning is required for comprehension of Mendelian genetics as in understnding of the nature of probability, correlation represent the corner stone of much of the descriptive investigation work of the biologist.

Productive thinking conceived as constructing, writing or otherwise producing solutions can be sontrasted with finding the correct solution or researching the goal. The distinction drawn by Guilford (1956) between convergent thinking and divergent thinking must be clearly made because traditional problem solving experiments have often reported solutions that did not fall neatly into either success or falure categories. Creative thinking in this sense represents divergent thinking.

While on the surface atleast, there may be little to indicate that Piagetian theory and creativity have much in common, a case for a common connection can be made. Duckworth (1972) has said that the development of intelligence is a creative affair. She argues that when

children are stimulated, creative acts arise from the connecting of ideas and actions and thoughts (in Piagetian term' schemes'). Pearce (1977) has said that all creativity is an expression of reversibility thinking. It is a combination of concrete and formal thinking. He told that the highly creative person acts as a Kekule or

OBJECTIVE OF THE STUDY

The study of XI grade science students was taken up with the following objectives :

1. To identify the science students of XI grade accoring to their levels of intellectual development and categorise them into (i) concrete operational, (ii) transitional operational and (iii) formal operational thinkers.

2. To classify the rural and urban students on the basis of various levels of intellectual development.

3. To identify boys and girls at different levels of intellectual development.

4. To examine the difference at various levels of intellectual development of students as

per the types of schools.

5. To classify the scheduled caste and non-scheduled caste students on the basis of various levels of intellectual development.

6. To find out the relationships between various levels of intellectual development with verbal, non-verbal and creativity scores.

7. To find out relationships between various levels of intellectual development of boys and girls with verbal, non-verbal and creativity scores.

8. To find out relationships between parents' education and intellectual development of students.

9. To find out the relationship between parents' occupations and intellectual development of students.

10. To study the impact of family size on intellectual development of students.

11. To find out the relationship between parents' income and intellectual development of students.

12. To compare the sex difference on creativity scores at different levels of intellectual development.

HYPOTHESIS

In accordance with the objectives of the study following hypotheses were formulated:

1. Majority of the science adolescent students are at formal operational level of intellectual development
2. Percentage of both Sexes different levels of intellectual development are equal in government and aided schools.
3. Percentage of both general and SC/ST categories students are equal at different levels of intellectual development.
4. There is no significant relationship between levels of intellectual development and creativity
5. There is no significant relationship between intellectual development and creativity in urban and rural sample
6. There is no significant relationship between creativity and intellectual development of boys and girls
7. There is no significant relationship between components of creativity and intellectual development of boys and girls of urban and rural areas.

8. There is no significant reltionship between intellectual development of students of government and aided schools

9. There is no significant relationship between creativity and intellectual development of students of government and aided schools in urban and rural areas.

10 There is no significant relationship between creativity and intellectual development of boys and girls studying in government and aided schools in urban and rural areas.

11. There is no significant relationship between creativity and intellectual development of general and SC/ST students .

12. There is no significant relationship between creativity and levels of intellectual development of students of urban and rural areas .

13. There is no significant relationship between creativity and intellectual development of boys and firls.

14. There is no significant relationship between creativity and levels of intellectual development of students of government and aided schools.

15. There is no significant relationship between creativity and intellectual development of general and SC/ST students.

16. There is no significant relationship between achievement in mathematics science and aggregate achievement

17. There is no significant relationship between achievement in mathematics science and aggregate achievement and intellectual development of students.

18. There is no significant relationship between achievement (in science, mathematics and aggregate) and intellectual development of boys and girls in government and aided schools or urban and rural areas.

19. There is no significant relationship between achievement(in mathematics, science and aggregate) and intellectual development of general and SC/ST students.

20. There is no significant belationship between achievement in kathematics and levels of intellectual development of science students.

21. There is no significant relationship between achievement in mathematics and intellectual development of students in government and aided schools of urban and rural areas.

22. There is no significant relationship between achievement in science and intellectual development of boys and girls.

23. There is no significant relationship between achievement in science and levels of intellectual development of students of government and aided schools .

24. There is no significant relationship between levels of intellectual development of the students with their aggregate achievement scores.

25. There is no significant relationship between aggregate achievement and levels of intellectual development of students of government and aided schools.

26. There is no significant relationship between intellectual development of students and education of parents.

27. There is no significant relationship between intellectual development of the students and occupation of parents.

28. There is no significant relationship between intellectual development of students and their parents' income.

29. There is no significant relationship between intellectual development of students and the sizi of family .

30. There is no significant relationship between intellectual development of general and SC/ST students and their socio-economic back ground.

31. There is no significant difference of creativity among the students at concrete, transitional and formal level of intellectual development .

32. There is no significant difference of creativity among boys and girls of rural urban and total sample.

33. There is no significant difference of creativity among the students of government and aided schools.

34. There is no significant difference of creativity among general and SC/ST students.

35. There is no significance differences among boys and girls, students of government and aided, students of general and SC/ST category, and urban and rural sample for their achievement in mathematics, science and aggregate achievement.

A S S U M P T I O MN S

The present piece of research rests on the following assumptions which helped in formulating and executing the plan of the study.

The students of Govt. and Govt. aided institutions come from almost similar backgrounds and also these schools are comparable so far as the learning environment and facilities are concerned.

The statements of students regarding parents income on the General Information Questionnaire have been considered to be the realistic measure of parents' income/ education although not fully authenticated.

In the present investigation only three components of creativity viz. Fluency, flexibility and Originality have been taken into account. Elaboration has, however, not been considered appropriate in the present context.

Rural/urban and government/aided school nomenclature has been adopted from the list of schools provided by the Delhi Administration.

Scheduled caste have been treated on the basis of students' disclosure.

Group Assessment of Logical Thinking by Michael J. Padilla et. al. has been used to measure the intellectual development in both English and Hindi. In Hindi version the institutions and names of persons objects were changed. The usability of the test was, however, ascertained by way of experts' judgement.

Creativity has been measured with the Hindi version of Torrence Test of Creative Thinking (TTCT), which is already in use in India.

Class X public examination marks have been considered as a measure of scholastic achievement of students.

Assumption underlying statistical techniques used would naturally constitute the basis for drawing conclusions for the present study.

DELIMINATIONS OF THE STUDY

The present study was delimited with regard

to its area, method, sampling, tools and satistical techniques. These are presented below:

The study has focused on the relationship of intellectual development and creativity and has been conducted through normative testing survey method. The intellectual development has been undertaken at three stages namely (i) Concrete operational (ii) Transitional operational and (iii) Formal operational. Only three components of creativity, viz.(i) fluency, (ii) flexibility and (iii) originality with regards to verbal and non-verbal aspects have been considered to provide scores for students' creativity.

The study has been confined to a total sample of 1026 students,(370 girls and 656 boys), studying in senior secondary schools of Delhi. The age range of the students was from 15th to 17 years.

Group Assessment of Logical Thinking (a paper pencil test) by Michael J. Pedilla it.al. was used for investigating adolescent thought and classification of

the students at concrete,transitional and formal operational levels of intellectual development.

T E R M I N O L O G Y   U S E D

In view of the various explanations advanced for each of the variables dealt with in the present study, it was considered essential by the investigator to restrict and delimit variables in terms of the following definitions.

Creativity

Torrance(1962) defines creativity as 'The process of sensing gapes or disturbing missing elements, forming ideas or hypotheses concerning them, testing these hypotheses and communicating these results, possibly modifying and retesting the hypotheses'.

Fluency : It respects the quantity of production within limited time and has no consideration or quality. Only acceptability of a response, within the broad restrictions of the instruction is applied as a criterion.

Flexibility : Shifts in responses are the main criterion of flexibility, 'Shift' is going from one class of uses to another.

Originality : It is determined by unusual responses. It is approached with three alternative principles (Wilson et.al. 1953), i.e. variety of response, statistical infrequent response and unusual responses are termed as original responses.

Intellectual Development

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Intellectual Development

The construction of mental structure is a fundamental process of intellectuab development. Mental structure provides the basis for our pattern of reasoning, which determine 'how and what we think' and 'how we interact with our environment'. In a real sense our mental structures are reasoning pattern and represent our knowledge about physical world and the world of ideas. Piaget (1950, 1952) understands mental structure which, in the course of development, achieves an increasingly comprehensive and perfect state of equilibrium. The different stages corresponding to structures are :

(i) the stage of sensori-motor intelligence upto the age of 18 months; (ii) the stage of preoperational thought upto the age of about 7 years; (iii) the stage of concrete operational thought upto eleven years; and (iv) the stage of formal logical operations, when the adolescent is able to think reflectively about the logical operations themselves and use them systematically. This Piagetian model of the genetic structures of childrens' minds were

based on symbolic logic and mathematics of groups and sets.

With the help of his symbolic logic Piaget distinguishes among the availability of various logical operations at various age levels, e.g. combinativity, reversibility, associativity and identity, etc. are available at concrete stage while the operational schemata like combinational, proportional mechanical equlibrium, correlation and probabilities, etc. at the beginning of the formal operational stage.

Transitional Operational Stage

Many times we find that a child has attainded the concrete stage completely and alse attained the formal stage partially, but would not attain the formal stage completely. Such students are classified in transitional stage.

Logical operation In the Piagetian sense of operation is a mental action within the person. It modifies the object of knowledge and renders the individual capable of understanding the structure of the transformation that has come about e.g. put an object in a class, construct a classification, organise the objects, build series etc.

Piaget et.al. as a result of his vast research

programmes, enunciated various schemes of thought along with experiments (commonly known as tasks), which are developed for adolescents. These are, for example relating to combinations, proportionality, correlations, probability and reciprocity etc.

Vanita Roadrangka, Russell H. Yeany and Michael J. Padilla developed a paper pencil tasks for investigating adolescent thought. The test measures six logical operations conservation, propertional reasoning, controlling variables, probabilities reasoning, combinational reasoning and corr correlational reasoning. The glossary of these logical operations are given in Chapter III.

Academic Achievement

It may be expressed as scholastic achievement of an individual in a particular branch of knowledge (in the present study science and mathematics) after a definite period of learning and training of a prescribed course (Lawrenz,F. 1976).

Caste

Children are categorized into scheduled and non-scheduled castes on the basis of the classification of castes recommended by the Commissioner of Scheduled Caste and Scheduled Tribes.

Parents' Education

Fathers' and Mothers' educational qualifications, of the students, were considered as parents' education.

Parents' Occupations

Fathers' and Mothers' occupations were considered as parents' occupations of the students.

Family Size

The total number of children and parents have been considered as family size of a family.

Parents' Income

Total income per month of mother and father has been considered as parents' income.

Environment

Urban areas : The urban area has been considered a place with all sorts of urban facilities of District Head Quarters as accepted by the Directorate of Education, Delhi Administration, Delhi.

Rural Areas : The rural area has been considered a place as accepted by the Directorate of Education, Delhi Administration, Delhi.

Types of Schools

Only two types of schools have been considered for this study (i) government schools, the institutions run by government agency, as recognised by Directorate of Education, Delhi Administration, Delhi. (ii) aided schools these institutions are run by private managements with financial support of the government, as recognised by the Directorate of Education, Delhi Administration, Delhi.

CHAPTER : II

REVIEW OF THE RELATED LITERATURE AND STUDIES

C H A P T E R   I I

REVIEW OF THE RELATED LITERATURE AND STUDIES

I N T R O D U C T I O N

The review of the literature in educational research provides one with means of getting to the frontier in a particular field of knowledge. According to Miller (1965) research worker must be aware of what is known with some degree of certainty, what is accepted as truth by some but not by others, and must have some inkling of the nature of unexplosed areas where additional research should be conducted.

Borg and Walter state that, 'the review of the literature on educatinnal research provides one with means of getting to the frontier in a particular field of knowledge'. It involves locating, realising and evaluating reports of research as well as report of observation and opinions that are related to the individual's planned research project.

As such the review of the literature is necessary for scientific approach and is reported by almost all the investigators in areas of scientific research. The investigator cannot have an insight into the problem to

be investigated, unless and until he has learnt what others have done and what remains to be done in a particular area of interest. Thus the, related literature, besides forming one of the early chapters in a research report for orienting the readers, also serves some other purposes which are given by Good, Barr and Scates as follows (i) to know whether the evidence already available solves the problem adequately without further investigation and thus to avoid the risk of duplication, (ii) to previde ideas, theories explanations or hypotheses valuable in formulating the problem, (iii) to suggest methods of research appropriate to the problem, (iv) to locate comparative data useful in the interpretation of results and (v) to contribute to the general scholarship of the investigator.

JUSTIFICATION OF LITERATURE

The researcher has tried to find out the needed studies in the areas of intellectual development, creativity, academic achievement and socio-economic status and during his hunt for the related literature it was found that there was no study available which was parallel to the present study. All the studies had either different combinations of variables or were taken at diffeeent levels and on differnt sample. The researcher also tried his best to review foreign

as well as Indian studies necessary for this project. These reviews are presented under the following headings

1. Studies related with intellectual development
2. Studies related with intellectual development and achievement in science.
3. Studies on creativity.
4. Studies related with intellectual development and creativity.

STUDIES RELATED TO THE INTELLECTUAL DEVELOPMENT

Bruner (1966) maintained, that mental growth was essentially discontinuous and therefore best described by stage development theories rather than theories postulating gradual acceleration process. This is one of the several important conclusions concerning our understanding of human being on genetic development. Since then the stage developmental 'not only has remained a dominent view point in psychology but has gained a steadily increasing importance in the thinking of education. This evident both from the attempts made to construct school Science curricula fitted to developmental level and to analysing existing courses by the same criterion, e.g., Piaget's theories have been used to guide curriculum planning in the writing of materials for the Australian Science Education Project (1920),

and in Britain the School Council's 5113 projects have similarly been developed as a science teaching schime in which his ideas and findings are widely used in preparing materials. Hall (1971), Ingle and Shayer(1971 and Shaye Shayer (1970-72) in a series of three articles have prescribed courses based on Piaget's developmental stages and have demonstrated its usefulness by providing a close analysis in these terms of Nuffied 'O' Level Courses in Chemistry and Physics.

There have been a number of researchers to study the developmental level by using Piagetian tasks. Piaget and Inhelder (1958)

Elkind (1962) administered three Piagetian tasks on 240 college students and found that only 58% students were clear about the conservation of volume concept. He also reported that most of the college students were still at the conceete operational level.

Jackson (1965) studied the growth of logical thinking in normal and sub-normal children and found that about half of the sample population attained the formal operational stage. Evidences are available to the effect that a sizable number of children do not reach formal operational level.

Lovell. et.al. (1966) reported that majority of the adolescent pupils do not reach the formal operational level.

Dule (1970) also reported that very few adolescent perform at the formal operational level.

Kohlberg and Gilligan (1971) were of the opinion that all normal children reach the concrete operational level at their adolescent stage but it is not true that all must reach the formal operational level.

Hale (1972) found that large number of his sample subjects were at the concrete and Transitional Operational stage. A study conducted on 131 college freshman (McKinnon 1971) showthat 50% were at the concrete operational level, 25% were at the formal operational level.

Lang (1972) also found that even eleventh graders fail to mainfest formal thinking on problems dealing with mass, weight, properties, speed, velocity and acceleration.

Not only normal children but also sizable number of gifted children do not attain formal thought. It is reveraled by the study of Duilt (1972) that two fifth of gifted children in the age group 16-17 years failed to attain formal operational stage. He also reported that two-third of the general population failed to achieve formal thought.

Farrell (1969) reported that the percentage of formal level thinker decreases and may revert to the lower level of cognitive development. Howe(1974)

reported that even Upper level secondary students ex excepts a few who were bright, could not reach formal operational level for the solution of most problems on Piagetian tasks.

Renner and Stafford (1972) studied the intellectual level of 290 students of grades X? XI, living in the state of Oklahoma and administered 6 Piagetian tasks to assess the intellectual level. It was found that about 66% were at concrete operational level, 20% at the transitional stage and 14% at the formal operational stage respectively. In another study Renner and Stafford (1972) investigated the level of intellectual attainment of 298 Junior High School students of grades 7,8 and 9, living in various parts of Oklahoma. Six Piagetian tasks were administered and it was found that 77% were at concrete operational level, 13% at post concrete level and 6% at the formal level.

Lawson and Renner (1974) administered six Piagetian tasks on 588 students of class seven to twelve from 25 schools and the subjects were in the age group of 8.3 years to 11.3 years. It was found that 32 students were at the formal level, 113 were at the post concrete level and rest at concrete level. In another study Lawson and Renner(1974) selected 143 college freshment from Oklahoma and administered five Piagetian tasks. They reported that 52% at post

concrete level and 22% at the formal operational level.

Docherty (1974) reported that from a Piagetian point of view a relatively homogeneous group of children can be identified as concrete and formal operational pupils through cluster analysis, using Piagetian tasks.

Cognitive development was also studed in different cultural groups.

Nordland et.al. (1974) conducted a research study to judge the reasoning ability of 96 randomly selected seventh grade students from a predominantly black and spanish American urban high school. Tem Piagetian tasks were administered. It was found that about 83.4% of these students were at the concrete level and 15.6% were at the formal operational level.

Lawson and Blake (1974) studied the abstract thinking ability of 68 high school Biology students. He selected students from a rural area of North Central Indiana. Their age ranged from 14 years 7 months to 17 years 10 months. He used three Piagetian tasks and found that 47% were at concrete operational level and 53% at the formal operational level.

Chiappetta and Whitefield (1974) studied the cognitive development of 26 randomly selected high school seniors of Houston Texas of various academic group (college preparatory, General and vocational). Their

study shows that (i) in vocational group 61.5% were at the concrete operational level and 38.5% at the formal operational level (ii) 53.8% were at concrete operational level and 46.2% at formal operational level in general track group and (iii) in college preparatory group, 27% were at the concrete operational level and 73% were at formal operational level.

Gamoka (1978) studied the structure of intellectual abilities with the Piagetian formal operational tasks. A factor analysis revealed that the differentiation of the structure of the intellectual occurs mainly during the early concrete Piagetian stage of development and integration found in formal Piagetian stage.

Lawson (1977) administered 3 formal operational task on 28 children (14 males and 14 female) and conducted individual interviews. During the interviews, notes on subject behaviours and verbal responses were made. The notes were later used to score subject's performance on each task. These scores later categoriezed into Piagetian concrete and formal levels of intellectual development by two independent raters. Responses on each task ranged from early cohcrete to fully operational. It was found that correlation coefficient among performance on tasks ranged from 0.60 to 0.70 . The tasks were found to have a high degree of internal

homogeneity (HR = 0.66).

Upadhyay (1978) selected 100 students (50 boys and 50 girls) of XI grade science belonging to Ajmer City for his study. He administered 5 Piagetian tasks individually and Ravin's Progressive test of intelligence. The main findings of the study were (i) There were 38% students at concrete level, 40% students were at post concrete level, and 22% students were at formal level, (ii) No significant releationship existed between the scores of intelligence and different levels (concrete, post-concrete and formal) of intellectual development

Pandey (1979) reported that 8.44% of the class XI science students were at concrete operational stage, 12.66% at post concrete level and 15.60% at formal level.

Mathur (1981)investigated the 'Growth of Experimental Mind During Adolescence' on a sample of 120 pupils studying in VI through XI, ages between 11+ to 16+. She found that the performance on Piaget type task show an increasing trend with grade with occassional fluctuations on certain tasks.

Jain (1984) in her study found that (i) Majority of the adolescent pupils at 11+ to 14+ were not in a position to reason formally, (ii) More than 50% were in a position to reason formally on the schemes of grasping the essence of the problem, using constant difference, classificatory reasoning and combinational reasoning on

the other hand, they were not in a position to reach formally on conservation of volumes, probability reasoning and proportionallty reasoning. There was an increasing trend of adolescent thought with age.

De Lacey's (1970 a,b) study on European Children belonging to lower socio-economic class revealed that the performance of these children was low on Piagetian tasks. The study also revealed that ... Australian European children belonging to lower socio-economic group had not reached cencrete operational thinking (classification) level at the age of 12.

Higgins Trenk and Gaite (1971) reported on the basis of their studies on formal operation with American subjects that normal adolescents did not reach the formal level of thinking at the age of sixteen. Even if they reached the formal stage it should be at the age of 19 or 20.

Dasen (1975) extended Berry's (1977) model of ecological functionalism to Piagetian developmental psychology. It was hypothesized that the rate of development of concrete operation was partly determined by ecological and cultural factors. In particular, if there subsistence economy populations are placed on a eco-cultural scale, with low food accumulatimg, sedentary, agriculturalist groups at the other extremes the former was expected to develop spatial concepts

more rapidly that the latter, whereas the sedentary group is expected to attain the concepts of conservation of quality, weight and volume more rapidly than nomadic group will. The results generally supported the model in a study involving 190 children aged 6 through 14 years from 3 cultural groups Canadian eskimos, Australian, aborigines and Ebric Africians.

Opper's (1976) results show that the rate of development of Swiss children and Thai urban children was found to be almost identical where as a 'time lag' appeared for the rural children.

Karplus, et.al. (1977) surveyed the proportional reasoning and control of variables in seven countries. They administwred two Piagetian tasks (ratio paper clip task and conrol of variables tasks by Wellman) to approximately 3500 students on Comenhagen (N=1020), Austria (N=595), Germany(N=319), and Great Britain (N=376). The two tasks were translated into five languages and presented in collaboration with science education research groups in each country. The researchers analyzed test performance in terms of students, country, gender, socio-economic status and achievement level depending on the school organization in each country. It was found that differences in achievement among countries were smaller than differences among groups within a country.

experience they have in school and at home.

Bevly (1979) administered four pPiaget type task on 742 children of age rang 6+ and 12+. The sample was drawn from three schools representing three different types of environment (i) an urban disadvantaged group (ii) an urban advantaged group (iii) a rural disadvantaged group. She found that (i) the children from poor quality schools and low socio-economic status though in the urban areas, reach operational stage at a much batter age, (ii) rural children do not reach operational level at all even at 12+, (iii) the rate of cognitive development in the three Indian samples studied was different and (iv) the urban children whether belonging the public school (higher socio-economic status group) or corporation urban school (Lower socio-economic status group) had a definite and significant correlational trend at all age levels under investigation between intelligence and cognitive development but the same type of definite trend is not evident in the rural children.

Sandhu (1980) in his doctoral study, on the 'Factrorial study of Adolescent Thought' investigated the thinking processes of adolescent of rural background between the age group 11+ to 15- using 10 Piaget type tasks and found that (i) the performance on Piaget type tasks increased with age during the formal operational

period and the boys did fare better than girls at the respective age levels, (ii) intelligence and academic achievement had direct ring on adolescent thought, and (iii) the ddvelopment to formal thinking leads to better adjustment of the individual and vice-versa.

Pachauri (1976) studied science pupil-teachers. He administered three Piagetian tasks and found that there pupil teachers were at the early formal operational stage that is, the transitional stage.

Jurascheck's (1974) study involved 141 prospective elementary school teacher, 19 secondary mathematics student-teachers and honour calculus students, He administered three Piagetian tasks and found that (i) in prospective elementary school teachers, 48% were at formal operational level, (ii) only 1% was at the concrete operational level and 99% were at the formal operational level in mathematics students-teachers and (iii) in honours calculus no student was found at concrete operational level. All students were at the formal operational level.

Joyce (1977) administered five Piagetian tasks on 66 science teachers in the elementary schools. 80% of these teacheres were in the age 19-22 years while the others were older. The results showed that about 77% were at the formal level while about 8% were at concrete level and about 15% at transitional level.

Students on the role of sex in cognitive development show that by and large the males are better than their female counterparts in their performance on Piagetian tasks.

Graybill (1974) studied the sex differences in t transition from concrete to formal thinking patterns and noticed sex differences varying in boys and girls in their logical thinking.

Lawson (1975) undertook a study with a purpose to assess the Piagetian level of performance of males and females on two manipulative tasks of concrete and formal reasoning ability. He concluded that for all the measures the males' mean level was higher than that of the females'.

Michael (1977) studied the sex differences in formal thought. 30 males and 36 females formed the sample of his study. 12 Piagetian tasks were administered on the sample group. It was found that males out performed females. Deluce (1981) administered six Piagetian tasks to 182 males and 175 females age 9 through 18 years old. Results showed that Piagetian stages exist in a general sequence through which intellectual progress. However males were better than females in Piagetian tasks.

Fredrich (1981) studied the influence of Piagetian task and gender on cluster patterns. Six Piagetian tasks were administered to 182 males and 176 females aged 18.

It was found that males conformed more Piagetian stages than their female counterparts. The deviation from Piagetian stages was influenced by gender. It was also reported that the greatest discentinuity occured for the males between sub-stages III A and III B, not between II B and III A as reperted by Piaget.

Ehindero (1982) studied cerrelates of sex related differences in logical reasoning. Result showed that males scored higher than females in male related rasks and female scored higher in female related tasks. However significant difference was observed on content free tasks. Tohidi (1983) studied the sex differences in cognitive performance on Piagetian like tasks and reported that the sex differences were found in favour of males, with a slight superiority of girls in classification and seriation.

Graybill (1974) attempted to determine the possible existence of sex difference in intellectural development and problem solving ability. Children between the age of 9 and 15 were slected for the study. The sample consisted of three pairs of boys and girls of about 9.11, 13 to 15 years of age. These pairs were matched as well as possible with respect to birth date, I.Q. school achievement, and socio.economic background. Each subject was asked to solve four problems selected equal angles, floating bodies, rods, and chemical combinations. Interviews were recorded on tape for

analysis. It was found that (i) girls differed from boys in the point at with they developed logical thinking abilities as defined by Piaget and Inhelder. Boys began to score at the formal level at 13 years of age while the girls lagged behind. There was no girl in the sample who scored consistently at the formal level, (ii) boys and girls began to show difference in logical thinking ability at about 11 years of age. (iii) boys were more successful than girls in solving the science problems selected for this study. The data showed that boys scored better than girls on every experiment at each level, except for the chemical combination results in the 9 years old female group. Which were in favour of boys. It would be interesting to refer Somerville (1974) who reported that the development of formal thought is strongly dependent on age rather than sex, even the type of schools.

Kale and Danke (1976) reported that (i) the mathematics scores were related significantly to age grade, sex and school type but not to SES? (ii)cognitive development had little relationship with language achievement and mathematics achievement, (iii) the cognitive development was related significantly to age, grade, groups, and school type and (iv) cognitive development had curvilinear relation with medium of instruction and negligible relationship with E.Q. and sex.

Norland et.al. (1970) studied the intellectual level of 506 science students. The subjects age ranged from 13.6 years to 20 years. They were administered ten Piagetian tasks and the results showed that 85% children were at concrete operational level and 13.2% at formal operational level. Lawson(1974) analysed the relationship between concrete and formal operational science content and developmental level of learner. The sample was collected from high school in Norman, Oklahoma of 51 Biology, 50 Chemistry and 33 Physics students. Four Piagetian tasks were administered results were as follows (i) 64.8% were at the concrete operational level and 35.2% were at formal operatonal level among Biology students, (ii) Out of 50 Chemistry students, 22% were at concrete operational level and 78% were at formal operational level and (iii) out of 33 Physics students, 36% were at concrete operational level and 63% were found at the formal operational level.

Lawson and Renner (1975) administered four Piagetian tasks to assess understanding of concrete and formal operational concept of secondary school students. In the study 51, 50 and 33 subjects were randomly selected from Biology, Chemistry and Physics classes respectively. Data indicated that approximately 64.8% of the biology students were operating entirely or particularly at the

concrete level. The chemistry sample was best cha
characterized as transitional thinker with 92% of those interviewed categorized above concrete operational IIB and below formal operational IIIB. The physics sample also sonsisted largely of students operating some where between fully concrete operation IIB and fully formal operation IIIB. Approximately 85% of the students were classified above concrete operation II B, and below formal operation III B. only 48% of the entire sample or 134 students were judged to be formal operational III B thinker.

Rowell and Hoffman (1975) in a study 'Distringuishing formal from oconcrete thinker' 193 samples (110 boys and 83 girls) participated in Chemical experiments and 189 of the same students (107 boys and 82 girls) participated in the pendulum experiment. The results of the chemical and pendulum test classified according to the four developmental sub-level IIA. IIB, He found dual trends of increase in percentage of formal thinkers with increase in chronological age and the higher percentage of formal thinkers in the upper stream at the various grade level.

Vaidya (1975) studied the growth of logical thinking in science during adolescence on a sample of 100 boys and 100 girls studing in grades VI to X

matched on intelligence and socio-economic status. The main finding of this study were (i) except for occassional fluctuations, average performance on each problem increases with grade. Mean performance in most of the cases favour boys rather than girls, however, they more into higher grades, (ii) a given problem wad solved successfully (or failed) over a wide I.Q. range both within and across the various grades, (iii) adolescent pupils were affacted by the content of the problem than the nature of the problem. (contrary to Piaget's view), (iv) adolescent pupils were in a position to set up hypotheses, they were not in a position to test them which showed that their minds had not yet become experimental. (contrary to Piaget). (v) the top group differed from the bottom group on all the five measure of adjustment, understanding of the problem and all the seventeen schemes of thought.

Lawson, Floyed and Devito (1975) administered four Piagetian tasks to determine interrelationship of students' scores on these four tasks and scopes on commonly used standardized verbal and mathematical aptitude examinations and science, mathematics and english achievement examinations. Finding of study were (i) the majority, 66% of the sample demonstrated transitional responses (ii) the correlations among the Piagetian

scores and sub-sequential test of educational progress in science were fairly high and significant at the .001 or .001 level and (iii) correlation with the achievement in science were also fairly high and significant. Some of the correlation with achievement in mathematics and english were somewhat lower than those for the science examinations.

S U M M A R Y

As one goes through the research literature it is found that research conducted out-side Geneva still deals more with concrete opperational stage than formal operational stage of cognitive development. Researchers realised that this age limitation may not be applicable to other adolescent of the world. Uiggings(1981) concluded from their tstudy on formal operations with American subjects that normal adolescents were unable to reach the formal level of thinking. Even if they reach that level, it should at their late ninteens or early twenties. The conclusions drawn on the basis of researches reported are as follows (i) all normal children reach the concrete operational level but they do not necessarily reach the formal operational level (ii) many students do not reach

formal operational level for the solution of most of the problem, (iii) the analysis of various studies based on scores of atleast three (and usually more) Piagetian type tasks, (iv) various studies conducted senior school level of grades (9,10,11) show that majority of students belong to concrete operational level and few in post-concrete and formal operational level, (v) the most of the adolescents and young adults are at the concrete operational level, (vi) the students develop the ability of formal operational thinking with increasing age and grade level (vii) many adolescents are somewehere in transitional stage between concrete and formal operational stage of intellectual development.

STUDIES RELATED TO THE INTELLECTUAL DEVELOPMENT AND THE ACHIEVEMENT IN SCIENCE SUBJECTS

One of the domain in which Piaget's work is likely to have its greatest impact is the area of science and mathematics teaching. Piaget has repeatedly mentioned that the order in which a person develops through the stages in the models is constant and in order to move from stage to stage the individual must be confronted only with these activities and situation which can be understood by him in present stage. Thus a concrete operational thinker does not become formal operational by

constantly being confronted with formal operational tasks and concepts. He must meet situation which are at the concrete level but which also will add to and challenge his thinking ability to promote progress to higher levels.

Although each of the science subjects includes abstract conceptual schemes, the degree of abstractness at high school science stage generally increases from biology to chemistry to physics (Bates, 1975).

Some studies relating to cognative development and science achievement indicate that the subjects who perform at the formal operational level in Piagetian tasks function at the concrete operational level only for various concepts in science.

Sheehan (1970) studied the effectivenees of concrete and formal instructional procedure with students of concrete operational and formal operational students. A sample of 104 science students were randomly selected from a school at New York. The range was from 12 years 6 months to 13 years 5 months. Intially the students were classified at concrete or formal operational level using a list based on Piagetian theory of congnitive development. The effect of students understanding equilibrium in the balance bar, angles, evidence and reflection and of oscillation of pendulam was measured. The formal operational procedures and the concrete

operational students achieved significantly higher scores as a result of concrete instructions rather than formal instructions. The study revealed that the regression effect in this discussion of the improved performance of formal operational subjects for concrete instructions, but not for formal instructions.

Lawson (1974) reported that the regression effect demonstrated by students classifed as formal operational when tested on formal science content. He found that the formal operational subjects understand significantly more formal concept than the concrete ope operational subjects. The formal operational individuals also demonstratd a great deal of more understanding of concrete concepts than of formal concept in science.

Chiappette (1974) reported that large number of individual related at the formal operational level functioned at the concrete operational level when tested their understanding of physical science problems. The subjects could solve correctly the problems by substitution into the mathematical formulac but they could not give examples to show their understanding of the underlying concepts or theory invelved.

Sayre and Ball (1975) conducted a study on the sample of 419 students in a grade seven to twelve. Piagetian type tasks developed by them were administered

to each subject. Students successfully completing four or five tasks were classifed a formal operational while successfully completing three or less out of the five tasks were classifed as non-formal operational. He reported that there is a relationship (significant at .01 level) between the number of task performed at the formal operational level and the scholastic science grades of junior high school students (r=0.33) and the senior high school science students (r= 0.46). There was also no significant relationship (0.1 level) between the scholastic science achievement of non-formal students and the number of task perform at the juniors and senior high school level.

Lawson and Balke (1976) classified high school biology student into concrete and formal stage using three separate instruments. In this study 68 high school biology students of age fro 14 years 7 months to 17 years 10 months were randomly selected. Three Piagetian tasks were administered to each student and classified at the different intellectual levels according to their scores. Biology content examination of 16 paper and pencil items was also administered to each students ability to use a variety of concrete and formal operations. The result of Piagetian task administered showed that about 53% of the students were at the formal

level and the biology content examination showed that only 35% of the students were at the formal leve. The non-science content examination result showed that 43% of the students were at the formal leve.

Kolodiy (1977) reported scores for high school and college freshment that are nearly equal ((35% and 32%) formal; 50% and 60% transitional; 15% and 8% concrete and significant different from the college senior sample (64% formal, 28% transitional, 8% concrete). Correlations were significant between SAT mathmatics and the two tasks scores, and between the chemical liquid task and SAT math/SAT verbal scores.

Wheelar (1977) conducted a study of proportional reasoning in high school chemistry. The sample consisted of 168 X-grade chemistry students drawn from large high schools in Canada. Four Piagetian task were administered on the sample subjects. The survey revealed that about 22% of the students were late formal 37% early formal, 22% transitional and 29% concrete. Significant correlations were also found between proportional reasoning in chemistry and achievement in chemistry.

Das Gupta (1977) conducted a study with the purpose of finding relationship between Piagetian logical thinking and achievement in science subjects, namely physics, chemistry and biology. Eighty four

science pupil-teachers studying, in R.C.E. Ajmer formed the sample for her study. The Reven's verbal logical easoning est and Achievement Test in Biology.

Physics and chemistry were administ red on the sample, The study revealed that (i) the proportion of prospective Biology, chemistry and physics teachers attained concrete operational thinking was 36.84, 38.88 and 20.68 respectively, (ii) no formal thinker were found in prospective biology and chemistry teachers, (iii) the proportion of prospective physics teachers attained formal operational thinking was 10.34. No significant relationship existed between achievement in biology and (a) concrete operational thinking (b) transitional operational thinking in prospective biology teachers, (v) No significant relationship existed between achievement in chemistry and (a) concrete operational thinking (b) transitional operational thinking in prospective chemistry teachers, (vi) No significant relationship existed between achievement in physics and (a) concrete operational thinking (b) transitional operational thinking (c) formal operational thinking; in prospective physics teachers, and (vii) teachers attained transitional operation thinking 63.15, 61.11 and 68.96 respectively.

Pandey (1979) reported that achievement in

physics, chemistry and mathematics increased with the advancement of levels of intellectual development.

The major conclusion of the researches reported are as follows (i) the degree of abstractness at school science stage generally increases from biology to chemistry to physics, (ii) subjects who perform at the formal operational level on Piagetian tasks generally score high marks in achievement in different subjects, and (iii) science concepts should be taught to the students according to their mental structures.

RESEARCHES ON STUDIES RELATED TO CREATIVITY

A perusal of the summaries of selected literature in psychology and psychiatry mentioned in annotated bibliography entitled 'Creativity and the Individual' edited by stein and Beinze (1960) indicates that investigators have touched upon diverse areas such as the criterion and other problems, the creative process, heredity, age, early experience, religion, personality characteristics and motivational factors, cognitive factors (mainly intelligence), ecological (home and environment, culture, psychopathology ans tstatistical studies of all these the large bulk is concerned with reporting on personality characteristics and motivational factors both in their acadmic aspects and emperical stunies. Raina's biliography (1971)

reflects a similar trend obtaining in India with the difference that theoretical matters are more abundant in Indian literature relating to creativity as compared to emperical one.

The question, what is the relationship between Intellectual Development (cognitive development in Piagetian context) and Creativity? has perhaps not been attended with any great enthusiam. It is seen that most of research studies on creativity deals with construction and standardization of creativity tests as also correlational studies involving creativity tests and other ability tests. Following is a brief review of such studies.

A Cognitive Correlates of Creativity

Commenting on the issue of relationship between Creativity and Interlligence, Foster(1971) pointed out, that it centers around two focal points (i) Creativity is proposed to be a destinct aspects of intellectual functioning and is practically independent of conventional intelligence, (ii) Creativity depends upon unique cognitive factors which within the hierarchical structure of intelligence.

The first stand point has been taken by several authors. They suggest two distinct aspects of intellectual functioning. According to Guilford(1950)

they are 'convergent thinking' and 'divergent thinking'.

Guilford (1950) predicts that the relationship between intelligence and creativity is low. Andrews (1930) finds correlations of 0.15, 0.02 and 0.03 between intelligence and imagination in studies. Walch (1946) finds a correlation of 0.25 between originality and intelligence.

Getzels and Jackson (1962) reported low correlation ranging from 0.132 to 0.378 between creativity and intelligence.

Several other authors (Stein, 1955; Phatak, 1962; Cropley, 1965; Yamamoto, 1965; Guilford et.al. 1966; Hudson, 1966; Madus, 1967; Raina, 1968; Parmesh, 1969; Passi, 1971, Sharma, 1972; Sharma 1974; Bedi 1974; Sandhu 1975; Bhattacharya 1979; Saxena, 1980; Mathur, 1981; Singh, 1984) reported low positive correlation between the measures of creativity and intelligence, However, Fleschar (1963) found a negative correlation between creativity and intelligence.

From the above studies it can be inferred that creativity is slightly related to intelligence and as such it constitute a separate cogitive factor which contribute little to conventional intelligence.

The existence of distinct factors of intelligence and creativity has been proved further

using factor analytic techniques. Guilford et.al. (1951,52), Wallach and Kogan (1965) and Cropley (1966) identified traditional concept of intelligence.

Wallach and Wing (1969), Dacey and Madaus(1971) Sultan (1962), reported separate dimensions of divergent thinking and intelligence. In other words, they supported the view that creativity is independent of conventional intelligence for all purposes.

According to contemporary studies Torrance (1962) Guilford (1967) creativity involves factors that come under the category of divergent thinking as constrasted to convergent think. Guilford predicted a curvlinear relationship to each other, i.e., there may be substantial correlation between creativity and I.Q. at the lower level of intelligence but when some critical I.Q. level has been reached creativity functions independently.

This view has largely been supported by the studies of Taylor 1964; Barron 1969; Majumdar 1970; Gakhar, 1975; Saxena 1982 and Pant, 1981.

Creativity and Personality Correlates

A great deal has been done to locate the personal qualities and attributes which make a person creative or distinguish scientists from non-scientists, artists from non-artists, science students from non-

science students on certain personality patterns which qualify them as creative persons.

Emperical research on the problem of creativity and personality relationships was studied by a large number of researchers like Mussen, 1953; Barron 1955; Kubie 1958; Torrance 1962; Foster 1971; Holland 1971; and several others. The following attributes or personality patterns of creatives were identified They (i) possesses non-aggressive and more faminine than nasculine traits of personality, (ii) have high ego strength, have case of recall and oedipal complexity, (iii) have high degree of origimality, humour, playfulness and relative relaxation, (iv) have strong sense of per performing some 'role in life', (v) have less concern for other people, authority, rules and regulations, (vi) are more autonomous and more self controlled, (vii) score high on tests of originality with regards to freedom of expression, rebelliousness, disorderliness, etc. and (viii) they are significantly better in abstract thinking , emotional stability, independence, ventursome, self concept control, intelligence and achievement.

In India, also many researchers like Ray Choudhary 1961; Ganguly and Bhattacharya 1965; Raina 1968; Paramesh 1969; Jha 1972; Joshi 1973; Goyal 1973; Arora 1974; Gakhar 1975; Tripathi 1973,

1976, 1979; Basu 1977; Bhargava 1979 and Singh 1981; conducted investigations on personality correlates of creativity. Their sample ranges from adolescent students to adults engaged in different Walks of life like, music science, literature, art, drawing and paintings etc. They also concluded the same pattern of personality traits of the creatives as listed above.

STUDIES RELATED WITH INTELLECTUAL DEVELOPMENT AND CREATIVITY

As evident from the review of researchers attempted by this researcher, most of the researchers aborad and in the country confined to the investigations of psychological, ecological, psycho-physiological, and some other determinants of creativity like first order variables and second order variables birth order, religion culture etc. Only scanty work has been attempted to establish relationship between intellectual development and creativity of adolescent students.

Duckworth (1972) opines that the development of intelligence is a creative affair. She contends, that creative acts arise from the connecting of ideas and more action thoughts (in Piagetian term 'Scheme' that a child possess, the better chances for creative intellectual acts to be produced.

Stoker (1972) attempted a study in 19 adult women with a purpose to determine the relationship between intellectual development and creativity. Piagetian style instrument and Torrance test of creative thinking (TTCT) were used for collection of data. It was found that Piagetian level and creativity has positively related with the degree of ego-centric thought shown in the responses.

Feldman (1974) concluded that the processof Piaget's intellectual advancement and creative production share over time and the solution becomes permamently incorporated into the mental structure of the individual.

Reven and Polankhi (1974) conducted a study on 111 fourth grades and 109 sixth graders. Levels of cognitive development were assessed by Reven's tests of logical operations (RTLO) and measures of creativity were obtained on the Torrance test of creative thinking (TTCT). It was found that direct relationship existed between intellectual development and verbal creativity.

Lehman (1981) conducted a study to examine the relationship between cognitive development and creativity of 24 subjects; all whites with a mean age of 14.26 years from the rural schools, and 66 subjects; perdominantly black population with a mean age of 15.17

years from the urban schools. Three instruments were administered to the subjects (a) Otis-Lennon Ability Test (b) Lawson's Classroom Test of formal reasoning and (c) Tormance Test of Creative Thinking. It was reported that Piagetian scores and creativity sub-scores were unrelated for rural white subjects. However, a high relationship was observed between two variables for the disadvantaged black population.

Kumar S. (1982) conducted a study to find out the relationship of Intellectual Development with creativity and achievement. The sample consisted 265 grade XI science students (139 boys and 126 girls) The Raven's Test of Logical Thinking (RTLO) and Torrance Test of Creative Thinking (TTCT) were administered to the subjects. The scores in science subjects obtained by these students in grade X (Rajasthan Board Secondary Examination) were taken as the index of their achievement. The main finding of the study were (i) About 13%, 70% and 18% of science adolescent were at concrete, transitional and formal operational thinking level of intellectual development respectively, (ii) Boys adolescents lead in their attainment of formal operational thinking level (10.14%) than girls (15.07%) percentage of girls reaching

at the transitional level of intellectual development was slightly higher (73.01%) than that of boys (66.94%) (iii) No difference was found in percentage of boys and girls at concrete operational thinking level of intellectual development, (iv) Non-verbla originality, Verbal flexibility and Creativity was found significantly correlated with intellectual development in case of boys adolescents. (v) Non-verbal creativity and total creativity test scores was found significantly correlated with intellectual development in case of boys science adolescents studying in private schools. (vi) Significant and positive relationship was exists between total scores of intellectual development and scores in science subjects viz. Physics, Chemistry, Biology and in total achievement scores. (vii) A high and significant relationship was found between achievement in science subjects and Transitional operational thinking stage of intellectual development. (viii) Significant relationship was found between achievement in science subjects as well as total achievement scores in case of boys and girls adolescents students studying in Government schools. (ix) A significant relationship is found in case of boys studying in private school.

C H A P T E R : III

PROCEDURE OF STUDY

CHAPTER III

PLAN AND PROCEDURE OF STUDY

The present chapter embodies the methodology design, sampling, procedure of the study, description of tools and statistical techniques employed for conducting present research study.

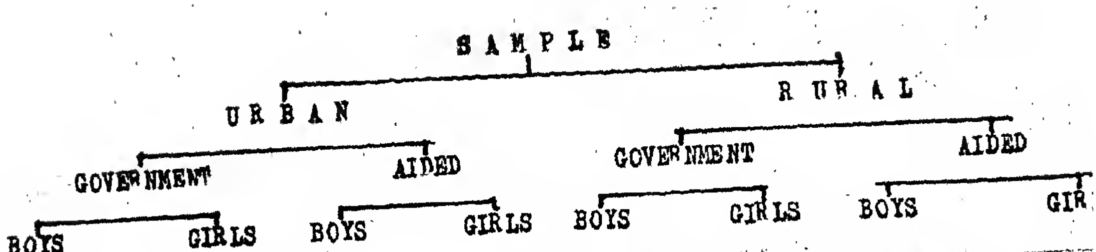
METHODOLOGY

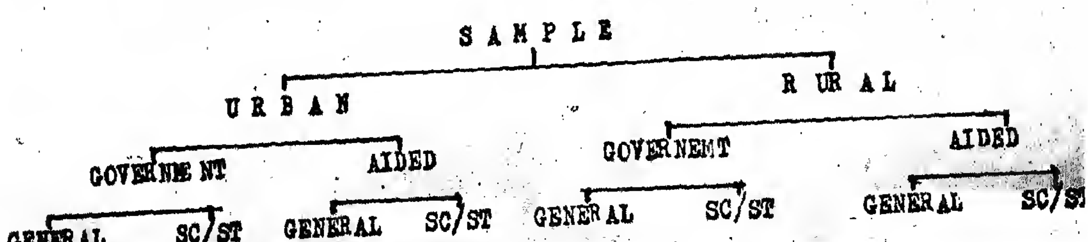
The focus of the study has been on studying the relationship of intellectual development with creativity, achievement and socio-economic status of grade XI science students. The study was conducted through normative testing survey method following the cross-sectional approach, as such the nature of the study has been correlational type. Besides studying the relationships between intellectual development and various dimensions of creativity, an attempt was also made to study the effect of type of schools, sex, parents' education, parents' occupations, parents' income, size of the family and environmental influence on intellectual development. Comparisions among scheduled caste/ scheduled tribes and general category students were also attempted vis-a-vis their intellectual

development. Creativity and achievement of the student were also studied with regard to sex, environment and type of schools at various levels of their intellectual development.

SAMPLING

The sample of the present study consisted of (656 boys and 370 girls) students offering science subjects at grade XI, drawn from the senior secondary schools of Union Territory, Delhi. All subjects belonged to age group (15-17) years. Stratified cluster sampling technique (Festinger and Katz, 1970) was employed. The sampling frame has been presented below





The above mentioned sampling frame indicates that representativeness was ensured to a great extent as government and aided, boys and girls schools were selected from both rural and urban settings in Delhi. The classification of rural and urban schools was followed as per the list of Senior Secondary Schools of Union Territory of Delhi (1984-85) published by the Educational Statistics Cell, Directorate of Education, Delhi Administration, Delhi. Further, an attempt was made to select schools from all the four Zones (north, south, east and west) of Delhi. The clusters of students obtaining in the selected schools were identified as subjects for the study. The schools were selected randomly as far as possible. However, due to constraints of availability the following deviations had to be accepted (i) the only, government girls senior secondary school appearing in the list of rural schools was selected (ii) No aided girls school was available for sampling in the rural areas. (iii) In the list of schools of rural areas only three head provision for science subject and these were in the north zone. Therefore, these three schools were included in the sample. (iv) No boys schools in the rural area of eastern zone had provision for science teaching hence none could appear in the frame. The list of selected schools is given in Annexure - A.

D E S C R I P T I O N   O F   T O O L S .

The tools used to measure the variables under study, namely, intellectual development, creativity, achievement and socio-economic status are described here.

GROUP ASSESSMENT OF LOGICAL THINKING (GALT)

This is a paper-pencil test of formal operations, developed by Vanita Roadrangka, Russell H. Yeany and Michael J. Padilla. The logical operations used for this test were identified from 'An Analysis of the Growth of logical thinking' (Inhelder, B. and Pieget, J. 1958) and the 'Growth of Logic in the child' (Inhelder, B. and Piaget J. 1964). Group Assessment of Logical Thinking (GALT) test possesses the following characteristics.

1. The test measures six logical operations conservation, proportional reasoning, controlling variables, combinational reasoning probabilistic reasoning and correlational reasoning.

2. The test uses a multiple-choice format for presenting options for answers as well as the justification or reason for that answer.

4. The test is suitable for students reading at the sixth grade level or higher.

5. The test has sufficient reliability and validity to distinguish between groups of students at concrete, transitional and formal stages of development.

6. The test can be administered in one class period to a large group by individuals who serve simply as

The following rules were considered as model of logical operations for the purpose of constructing test items that required a specific rule for the solution.

Conservation

For Piaget, conservation is a central pre-requisite for the acquisition and subsequent development of logical thought. According to Piaget, 'Every notion, whether it be scientific or merely a matter of common sense, presupposes a set of principles of conservation...' (Piaget, 1965) Piaget's contention is that conservation reasoning is a necessary condition of all rational thought, 'Conservation' concept is of theoretical interest because it reflects congnitive competence of some complexity, while the period of acquisition is the threshold to greater and more complex intellectual growth. In general,

the conservation can be divided into two distinct types (Buainerd, 1970).

a) The so-called first order quantitative in invariants (e.g. number length, area, mass, weight) and

b) The so-called second order invariants (e.g. volume, density, momentum, rectilinear motion).

Piaget considers the first order conservation indices of concrete operational thought and the second order conservation indices of formal operational thought.

The operation of general identity : 'Adding a null class leaves the other class unchanged. The identity can be combining a class with its inverse class'.

The concept of identity is of great importance in the study of the phenomena of conservation. The task of conservation of 'substances' or 'of the mass' are based on 'the operation of general identity'. The following two items are based on conservation phenomena.

Item 1 Piece of clay : Here the emphasis is on the amount of an object. Two identical balls of clay are shown on a balance weighing the same and one is then shown deformed in shape (pan cake) later on.

Item 2 Metal weights : Here the emphasis is on the volume of displaced water. Two identical jars of equal shpe and size and two metal balls of equal shape and size but of different witght are shown. One ball is put in each jar.

Proportional Reasoning

Proportional reasoning requires the subject to forecast all possible combinations in a double-entry table in such a way as to forecast proportions qualitatively and the latter quantitively (Inhelder and Piaget, 1958).

The relative magnitude of a ratio may increase-decrease, or stay the same with respect to the magnitude of another ratio if the magnitude of the variables are changed (e.g. $X/Y = X'/Y'$).

In the test employed the following two items are based on proportional reasoning

Item 3 Glass size : In this two glasses and two jars a small and a large one are shown in figures. Subjects, are told that 15 small glasses of water or 9 large glasses af water are needed to fill the large jar. 10 small glasses of water are required to fill the small jar. Then how many large glasses of water would be required to fill the small jar ?

Item 4 Scale : Using a scale as a balance beam and

hanging weights, this item test the subject's ability to balance various combinations of weights at various locations along the beam e.g. given a 10 unit weight at three unit distance from the fulcrum. The examinee was asked to predict the proper location of a 5 unit waight on the other side of scale to achieve a balance correct response with reason of this item implied understanding of inverse-proportion.

Control Variables

In this understanding is used to control variables in order to draw valid conclusions from observations made on testing. On the experiments of control variables the sufficient understanding of the concept. 'al other things being equal' to serve as a guide for behaviour i.e. to enable subject to set up and carry out experiment. In this test two items are based on the same.

Item 5 Pendulam : This item is based on exclusion of irrelevant variables. This item tests students' ability to control and exclude irrelevant variables. In the figure using three strings hanging on a rod, two of them are of same length with different weights i.e. 5 unit and 10 unit and one is with 5 unit weight. These strings with weight work as a simple pendulum; subject

were given the problem of determining the effect of the length of strings on the time taken to swing to and fro. The only casual factor is length of the string. Therefore the weight of the ball, angle of drop, and force or push must be excluded.

The correct response required understanding of the concept 'all other things being equal'.

Item 6 Ball : In this figure of a ramp a target ball at the bottom is shown. Two different points, a low point and a high point, are shown on the ramp. There are two other balls of different weight i.e. light and heavy. Ball can roll on the ramp. If a ball is released from any point on the ramp it hits the target ball. This causes the target ball to move up the other side of the ramp.

In this item was asked the effect of different point on the distance covered by target ball, when ball is released from the different points.

Probability

Probabilistic reasoning requires that the subjects deduction begins with possibility (i.e. hypothesis) to end up to a reality conceived of as a realized factor of the total number of possible combinations (Inhelder and Piaget, 1958).

In this the object that has the greatest frequency the one most likely to be choosen from a group. Following items are based on probabilistic reasoning

Item 7 and 8 Square and Diamonds 1 and 2 : In both items figures of three spotted squares pieces of wood, four 'black squares and five white squares are shown. Four spotted diamond-shaped pieces, two black diamond and three white diamond are also shown.

Item 7 : the subjects were asked to state the chance of drawing out a spotted piece.

Item 8 : the subjects were asked to state the chance of drawing out the spotted diamond or a white diamond.

Correlational thinking

In correlation a probability estimate of relations or law is made. In such problems subjects have to count the cases that confirm and those that fail to confirm a hypothesized relationship between the two variables. Correlation is not a simple probability i.e. an elementary ratio between the confirming cases and total number of possible cases. Correlation may be classified into following types

(a) The formation of a possible correlation occurs when the frequency of $(p.q.+\bar{p}\ q)$

is greater than the frequency of $(p.\bar{q} + \bar{p}q)$.

(b) the formulations of a negative correlation relationship occurs when the frequency of $(p.q. + \bar{p}\,\bar{q})$ is less than the frequency of $(p.\bar{q}. + \bar{p}.q)$.

(c) the formation of a no correlation relationship occurs when the frequency of $(p\,q + p\,\bar{q})$ equal to frequency of $(p\,\bar{q} + \bar{p}\,q)$.

In this test two items are based on correlation thinking.

Item 9 The mice : A picture of 16 fat mice with black tails, 6 fat mice with white tails, 2 thin mice with black tailes, and 6 thin mice with white tails is shown in test booklet. The subjects were told that these mice represented a sample of mice captured by a former from a part of his field, they were asked whether they thought there was a relation between the size of the mice and the colour of their tails.

Item 10 The fish : A picture of 4 large fish with narrow stripes, 2 small fish with narrow stripes, 3 large fish with vide stripes, and 9 small fish with wide stripes was shown in the test booklet. The subjects were asked whether they thought there was a relations between the size of the fish and the width of their stripes.

Combinational reasoning

This reasoning scheme is of interest primarily for historical reasons. It plays a central role in Piaget's model of formal reasoning as it is presumbably the purest measure of a subject's use of combinational system. The ability to conseive of multiple causes of a particular evant and of these possible causes operating in various combinations is important in hypothesis generation. At the level of the concrete operation, these combination always remains incompliete because the subject adopts a step by step method without generalizing. It is the level at which subject seems capable of combining elements by an exhaustive and systematic method. The subject is also capable of combining idea and or hypotheses in alternative or negative statements, and thus of utilizing proportional operation hitherto unknown to him. At the pre-adolescent level however the child manages easily (after the age of twelve for combination little later on permutation) to find an exhaustiv method, of course, discovering formula (which he is not asked to do) but by working out a system that takes account of all possibilities.

(i) Combinations : Combinations are multiplications The dance problem (item 11) is based on it.

Item 11 The Dance : In this subjects are required to make all the possible combinations (pairs) of boys and

girls (three boys and three girls) by taking only one boy and one girls at a time (not two boys or two girls) in order to make all different total possible combinations. There are nine possible combinations.

(ii) Permutation : When objects are counted they are in a particular order, the same objects might have been counted in a defferent order in fact, in a number of di different orders. How many ? This is the question of the number of permutations.

In general, if there are 'n' elements any one of these can be used as the first element given the first element anyone of the n-1 remaining elements can be used as the second, given the first two elements any one of the remaining elements can be used as the third, and so on. Thus the total number of possible permutation of 'n' element is (n-1) (n-2)........(2) (2) = n!

The symbol n! is read n-factorial 'The Shopping centre' item is based on permutation. In this item subjects have not written only number of possible permutation but also systematic symbols.

Item 12 The Shopping Centre : In this item subjects were given four figures of ships, each of which had the name of different purposes B, D, C and G ([illegible] in Hindi version). Students were asked to construct

all the possible combinations by using each element only once in a combination at different positions. There are 24 possible permutations.

Reliability

The test has 12 items 2 items per sub-test based on six types of logical thinking selected from an item pool of 21 items, as per suggested scheme for use of GALT. Authors have calculated test and sub-test reliabilities item difficulties, discrimination indices, means and standard deviations on the basis of data of 628 students for the item pool.

Authors have reported(2-alpha-alpha of cornbach) reliabilities for sub-test of conservation, proportional reasoning controlling variables, probability reasoning, correlational reasoning and combinational reasoning at 0.58, 0.76, 0.67, 0.83, 0.37 and 0.40, respectively. The reliability coefficient for the total test has been re reported as 0.85. Details of the statistics and indices of the test are provided in appendix

Validity

An over all validity coefficient of 0.71 has been reported by authors. Sub-test validity coefficients range from 0.45 to 0.88 with proportional reasoning being the lowest and combinational reasoning the highest. Coefficient for each test and total test have been indicated in the Appendix...XI

Classification of Students on The Basis of GALT Scores

The following scheme suggested by Padilla, M.J. was employed to categorise students into concrete, transitional and formal levels of thinking:

S C H E M E

S.N.	Categories	Range of Marks
1.	Concrete Operational	0 - 4
2.	Transitional Operational	5 - 7
3.	Formal Operational	8 - 12

Preparation of GALT in Hindi

Since the majority of science students to whom the test was to be administered offer science subjects in Hindi medium and are therfore not competent to respond properly in English, the Hindi version of GALT was developed by translating each of the items. In order to ensures genuinesseses of the translation viz - a - viz its usability without effecting the characteristics of the test, both versions were reffered to an expert pool of psychometricians and a commonly agreed version of the test in Hindi developed for use in the study.

MEASURES OF CREATIVITY

The measures of creativity was based on the scorses of the students on the Minnesota tests of creative thinkiing designed by E. Paul Torrance at the University of Minnesota The tests contained in the Torrance Battery are based on the creativity process defined by Torrance 1965 as a process of becoming sensitive to problems, deficiencies, gaps n knowledge, missing elements, disharmonics and so on, identifying the difficulty searching for solutions, making guesses, or reformulating hypotheses about the deficiencies, testing and retesting these hypotheses and possibly modifying and retesting them and finally communicating the results. This definition describes a natural human process. Strong human beeds are involved at each stage. If we sense some incompleteness or disharmony, tension is aroused. We are uncomfortable and want to x release the tension. Since learned ways of behaving are inadequate, we begin trying to avoid the common place and obvious (but incorrect) solutions by investgating, diagnosing, manipulating and making gurses or estimates (Torrance, 1974).

Torrance relied initially upon the Guilford model of intellect and modified the Guilford tests in such a way as to make them more exciting and somewhat easier for the child to cope with. Torrance and associates have tried deliberately to construct items that are models

of the Creative thinking and each contributing something uneque to the batteries under development. Test tasks are fairly complex and have features that make use of what 'we know about the nature of creative thinking process the qualities of the creative products and creative personalities' (Torrance, 1969). The content used by Torrance is verbal and non-verbal or in other words semantic and figural. Torrance measured four products of divergent thinking (i) fluency (units), (ii) flexibility (classes), (iii) originality (transformation) and (iv) eleaboration (implications).

Both the figural and verbal forms can be used from kindergarten through graduate school. The tasks or activities choosen for the tests are of those types that could be most easily and economically administered and scored. Although creative thinking may mainfest itself in other than verbal and figural forms, some of the most important products resulting from the creative thinking process are found in these terms. The author is not yet prepared to specify even the range and dimensions of the tasks and products necessary to provide a complete estimate of a person's creative thinking potential for dealing with figural and vembal materials. On the basis of author's analysis of the thinking mainfested by scientists, artists, and authors in making outstanding

creative achievement, he has tried to assemble batteries of figural and verbal activities that require kinds of thinking analogous to the thinking involved in recognised creative achievements. The selection of the tests in verbal and figural forms was guided by factor analysis of a variety of tasks constructed by the author. To ensure the widest possiblle coverage, releatively uncorrelated tasks were selected of description of these tasks reveals their diversity. The verbal parts used in the present study are (i) product imporvement (elephant toy) (ii) unusual uses (card board toys) (iii) unusual question (on cardboard boxes). (iv) just suppose (improbable situation). The figural part includes incomplete figures and parallel lines.

Product Improvement Activity

The product improvement activity has always been one of the most dependable measures. It is a complex task with a high degree of face validity. To most subjects at all age levels, it is an interesting task. It permits them to 'regress in the service of the ego and enables them to play with ideas that they would not dare express in a more serious task. (Torrance, 1974).

The fluencey score of the activity is the number of relevent responses produced. The flexibility score is the number of different approaches used in producing

ideas for improvement. The originality score is based on the statistical infrequency and appropriateness of the ideas processed.

Unusual Uses Activity

The task is in part a test of ability to gree one's mind of a well established set. This type of rigidity seems to increase with age and with mental disturbance.

The number of relevant responses produced by a subject yields one measure of ideational fluency. The number of shifts in thinking or number of shifts of uses gives one measure of flexibility. The statistical infrequency of these uses gives one measures of originality.

Unusual Questions Activity

This activity was adopted from a technique devised by Robert C. Burkhast of Pensylvania State University(1961). Burkhast developed the unusual question test as a measure of what he terms Divergent Power. He maintains that a factor that he has labelled 'Product Spirit Activity' is not sufficient for the production of a high degree of creative achievement. What he terms 'Divergent Power' is essential for such achievement and is considered to be critical for such achievement and is considered to be of critical importance for creativity in classroom.

His measure derived from this test correlates rather highly with his criteria for creativity in art and abstract divergentic score and divergent score.

Scoring is similar to the product improvement activity.

Just Suppose Activity

This activity is an adoptation of the consequences type test in Guilford's (1969) battery. This variation was designed in an attempt to select a higher degree of fantasy and to be widely effective with children. The subject is confronted with an improbable situation and asked to predict the possible outcomes from the introduction of new or unknown variables. In order to respond productively to this task the subject must 'play with' the possibility and imagine all of the things that would happen as a consequence. This type of thinking seems to be highly emportant in creative behaviour but many individuals are uanble to enertain such possibilities even to this extent, and find such tasks intolerable.

Scoring is similar to the product impoovement activity.

Repeated Figures Activity

The repeated figures activity is similar to the incomplete figures activity. The stimulus material is

parallel lines, the ability to make multiple associations to a single stimulus is tested in this activity. The parallel lines are open figures. The incomplete figures and parallel lines elicit the creative tendency to bring structure and completeness to whatever is incomplete.

In the repeated figure activities a deliberate attempt is made to stimulate all four types of thinking and to set up a conflict among the response tendencies represented by them.

Incomplete Figures Activity

The incomplete figures activity is an adaptation of the drawing completion test developed by Kate Franck and used in studies of creativity by Barron (1968) and others.

As is well known from Gestalt Psychology, an incomplete figure sets up in an individual tension to complete it in the simplest and easiest possible. Thus, to produce an original response, the subject usually has to control his tensions and delay gratification of this impulse to closure.

These activities are scored for verbal fluency verbal flexibility, verbal originality, verbal elaboration, figural fluency, figural flexibility, figural originality and figural elaboration. In the present study verbal and formal elaboration scores have been

excluded. The interpretation of the scores is as follows

Verbal fluency : This score reflects the test taker's ability to produce a large number of ideas with words. Since there are seven of the verbal tasks and each attempt to tap a somewhat different kind of ability or mental process, further clues concerning a person's mental functioning may be obtained byllooking at the subject's production for each of the separate tasks.

Verbal flexibility : This score represents a person's ability to produce a variety of ideas, to shift from one approach to another, or to use a variety of strategies. One would expect a person low in flexibility to have a tendency to stick to a narrow range of responses. Such a performance might be a result of a rigid pattern or habit of thinking, a narrow range of information and or experiences. In general, one would hypothesize an opposite interpretation of high scores. In some cases however, extremely high flexibility scores in relation to fluency may charaterize the person who jumps from one approach to another and is unable to stick to any one line of thinking long enough to really develop it.

Verbal originality : This score represents the subjects ability to produce ideas that are away from the obvious, common place, banal or established. The person who

achieves high score on verbal originality usually has available a great deal of intellectual energy and may be perceived as rather non conforming. He or she is able to make big mental leaps or cut corners in obtaining solutions, but this does not mean that the person is erratic or impulsive. In fact, the making of original responses requires the ability to delay immediate gratification or reduction of tension in order to get away from the obvious, essy but low quality response.

Figural fleuncy : The interpretation of the figural fluency score is basically the same as for verbal fluency.

Figural flexibility : The interpretation of the figural flexibility score is basically the same as for verbal flexibility except that we are concerned with figural rather than verbal modes of thinking. A person might be quite flexible in viewing, manipulating and otherwise using figural elements and at the same time be quite restricted in shifting approaches in dealing with words.

Figural originality : The interpretation of the figural originality score is similar to that for verbal originality except that the content is figural rather than verbal. Perhaps even more than in verbal originality, a high score requires an ability to delay gratification or reduction of tensions. Author's interpretation can be derived by

looking at the originality scores in relation to fluency scores. A person may produce a small number of responses one or few of them may be original. Another person may produce a large number of resopnses, all of which are high in roiginality. A third person may produce resopnses of high originality but be unable to choose no-original response but may elaborate the un-original resopnse to a high degree. These different kinds of performances represent obviously different kinds of mental functioning.

Reliability

Although most of the customary concepts of reliability are relevant to the assessment of creativity, the very nature of this ability creates a nomber of problems in interpretating reliability data. Most of the theories of creative functioning emphasize the significance of emotional factors, bodily states, group atmosphere and the like. There are some like Gordon (1961) who insist that 'In the creative process the emotional component is more important than that intellectual, the irrational more important than the rational'. Another difficulty in this content is that life experiences of an individual mighthelp or hinder creative functioning. Emotional physical, motivational and mental health factors also

effect creative development and functioning and are likely to lower the test-retest reliability. However, some of the reliability studies are reviewed below.

An experiment was conducted by Torrance to determine the extent to which unselected participating teachers and educational secreteries can reliably score responses to the verbal and figural forms, without any training. He found very high correlation 0.95 to 0.99 for fluency, 0.94 to 0.99 for flexibility, 0.66 to 0.99 for originality and 0.82 to 0.97 for elaboration.

In a number of test-retest reliability studies, as reported by Torrance (1966), reliability coefficients were generally found higher for fluency and flexibility than originality. However, these results were not confirmed in an other study (Dalbec, 1966) who obtained test-retest reliability coefficients of 0.59 for fluency, 0.35 for flexibility and 0.73 for originality over a four year period.

Using batteries consisting of most of the tasks included in verbal and figural forms A and B Sommers (1961) and Wodtke (1963) have also reported quite significant test-retest reliability coefficients. While Sommers reported reliability coefficient of 0.87 to 0.97 for his two samples, Wodtke reported the coefficients ranging from 0.34 to 9.79 for separate activities.

Mackler and Sho tz (1966) obtained test-retest reliability of 0.61, 0.62 and 0.71 for fluency, flexibility and originality, respectively between the first and second testing, 0.75, 0.74 and 0.66, repectively between the first and third testing.

Ro se(1965) using the product improvement test with 31 mentally retarded youngsters with an elapsed interval of about six months, obtained reliabilities of 0.86, 0.76 and 0.68.

Validity

A person can behave creatively in an almost infinite number of ways. Therefore, according to Torrance, it would be ridiculous to even try to develop a comprehensiv battery of tests of creative thinking that would sample any kind of universe of creative thinking abilities. Torrance does not believe that any one can now specify the number and range of test tasks necessary to give a complete assessment of a person's potentialities for creative behaviour. He does believe that the sets of tests assembled in the figural and verbal batteries, from A and B, sample rather a wide range of the abilities in such a universe. However, Torrance admits that these test tasks do not sample the entire universe of creative abilities.

Ogletree (1971) reported that the creativity measure exhibit a significant degree of concurrent validity in countries other than United States.

Various attempt have been made to establish validity and reliability of Torrance Tests of Creative Thinking, in India. Researchers like Goyal (1973) Raina (1970; 1971), Pathak (1962) have demonstrated validity and reliability of the tests. The first and second volumes of Creative Newsletter published by Department of Physics, Aligarh Muslim University, record various studies on validity and reliability of the tests. Gakhar and Luthra (1974) selected a sample of seventy two students from ninth and tenth grades for establishing the reliability coefficients of all the seven activities included in verbal form A. The correlation coefficients, with a two-week interval, range from 0.66 to 0.92 for fluency, 0.67 to 0.73 for flexibility and 0.46 to 0.91 for originality. In another study Gakhar worked out test-retest reliability coefficients was 0.62 to 0.67 for fluency, 0.60 to 0.76 for flexibility and 0.55 to 0.69 for originality.

All these studies shows that TTCT is quiet valid and reliable test and can be used with various groups of subjects in India. Confidence in these tests can be placed because of the recently reported long

range predictive validity study by Torrance (1972, 1979) using the publicy recognized and acknoledged creative achievement and self-reported peak creative achievement as criteria. Factorial validity of TTCT was also established by Busu and Jawa (1973).

Scoring

The scoring was accomplished as following (i) fluency in all cases was simply a count of the number of relevant, scorable responses made by the subjects. (ii) flexibility was simply a count of the number of different categories the responses fell into; and (iii) originality was obtained by summing the weights assigned primarily on the basis of statistical infrequency of the responses, obvious, irrelevant and incomprehensible responses were assigned zero. A separate guide for scoring originality was prepared for each of the tasks. No attempt was made to score degree of elaboration in the verbal and nonverbal activities.

MEASURE OF ACADEMIC ACHIEVEMENTS

The measure of Academic Achievement were based on the marks obtained in science and mathematics at the Xth grade public examination conducted by Central Board

Secondary Education, Delhi. The aggregate marks are the total marks obtained by the candidate in all the subjects examined and considered for the award of division. Sixty percent marks are considered for award of first division, Forty-five percent for the second division and Thirty-three percent for the third division.

GENERAL INFORMATION QUESTIONARIE

The measure of parent's income per month, parents' education, parents' occupations and size of the family were obtained on the information given by students on the investigator-made general information questionarie for socio-economic status. (Appendix - I)

THE PROCEDURE OF THE STUDY

After sampling general information questionnaire was administered on the subjects in order to collect personnel data with regards to parents' income (per month) parents' education, size of family. Further, GALT by Padilla M.J. and et.al. and TTCT (verbal and non-verbal) by E.P. Torrance were administered in succession; Board Examination results of grade X of the subjects were noted for their academic achievement. The obtained data were then subjected to statistical analysis. The results

were finally interpretated in the light of the objectives and hypotheses of the study, so as to obtain a set of finding emerging out of the study.

STATISTICAL TREATMENT

To give meaning to the raw scores it is necessary that appropriate statistical treatment be used for detailed analysis and interpretation of different scores, percentage, t-values and coefficients of correlation were computed for finding the significance, if any, among the gooups. The analysis and interpretation of the data is presented in the following chapter.

CHAPTER : IV

ANALYSIS AND INTERPRETATION OF INDIA

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

The value of research in education depends largely on the degree to which it's results are intelligently analysed, interprete and applied. The investigator wishes to present his findings in a lucid and parcise manner so that the result could be studied at a glance. To provide a comprehensive look and easy grasp the data collected is procuted in tabular forms. This is followed by analysis and interpretation in a systematic manner. Thus the present chapter is mainly devided into twoparts: (i) Presentation of data (ii) Analysis and interpretation of data.

PRESENTATION OF DATA

In this section the data is presented as frequency distribution and percentages of subject falling in each class internal. Since the variables on which the scores were obtained were intellectual development, creaticity, achievement and socio-economic status, the data are presented in this order.

LEVEL OF INTELLECTUAL DEVELOPMENT

The intellectual development of sample subjects was measured by the 'Group Assessment

of logical thinking (GALT). Obtained scored are organised as given in Table I in the form of frequency distribution and percentages.

TABLE I: FREQUENCY AND PERCENTAGE OF SCORES OBTAINED ON GALT.

Score	1	2	3	4	5	6	7	8	9	10	11	12
Freq.	22	47	70	124	168	204	146	93	76	34	21	21
%age	2.1	4.6	6.8	12.1	16.4	19.9	14.2	9.1	7.4.	3.3.	02	02

Table I indicates that the range of the scores on GALT is from 1 to 12. frequency distribution of scores is a unimodal one, the value of the mode lies at score 6. The graphical representation of the frequency distribution is presented in the form of a histogram in figure I which corresponds approximately to the shape of normal distribution Scores on GALT are used to classify the subjects as belonging to different levels of intellectual development namely, concrete, transitional and formal operational levels.

Creativity Scores:

Scores for creativity were obtained with the help of Torrance Test of creative thinking (TTCT) Scores were obtained on the total test and also on its parts, namely

TABLE - II

FREQUENCY AND PERCENTAGE OF SCORES OBTAINED ON NON-VERBAL ACTIVITIES OF T.T.C.T.

	ACTIVITY 1						ACTIVITY 2					
	Fl		Fx		Or		Fl		Fx		Or	
	F	%	F	%	F	%	F	%	F	%	F	%
0	--	--	--	--	023	02.2	--	--	--	--	016	01.6
1	--	--	002	00.2	072	07.0	--	--	001	00.1	138	13.5
2	002	0.2	003	00.3	133	13.0	001	00.1	014	01.4	175	17.1
3	--	--	008	00.8	140	13.6	004	00.4	021	02.0	194	18.9
4	002	0.2	32	03.1	118	11.5	010	01.0	044	04.3	145	14.1
5	010	1.0	051	05.0	133	13.0	021	02.0	102	09.9	127	12.4
6	024	2.3	074	07.2	099	09.6	047	04.6	195	19.0	095	09.3
7	021	2.0	089	08.7	057	05.6	075	07.3	194	18.9	055	05.4
8	027	2.6	102	09.9	074	07.2	113	11.0	216	21.1	029	02.8
9	081	7.9	105	10.2	060	05.8	250	24.4	184	17.9	023	02.2
10	058	5.7	113	11.0	037	03.6	305	49.2	055	05.4	011	01.1
11	073	07.1	124	12.1	026	02.5	--	--	--	--	008	00.8
12	068	6.6	093	09.1	015	01.5	--	--	--	--	005	00.5
13	060	5.8	066	06.4	008	00.8	--	--	--	--	003	00.3
14	065	6.3	053	05.2	009	00.9	--	--	--	--	001	00.1
15	078	7.6	044	04.3	006	00.6	--	--	--	--	001	00.1
16	068	6.6	026	02.5	005	00.5	--	--	--	--	--	--
17	044	4.3	024	02.3	004	00.5	--	--	--	--	--	--
18	041	4.0	010	01.0	002	00.2	--	--	--	--	--	--
19	066	6.4	003	00.3	002	00.2	--	--	--	--	--	--
20	053	5.2	003	00.3	001	00.1	--	--	--	--	--	--
21	045	4.4	001	00.1	002	00.2	--	--	--	--	--	--
22	033	3.2	--	--	--	--	--	--	--	--	--	--
23	041	4.0	--	--	--	--	--	--	--	--	--	--
24	066	6.4	--	--	--	--	--	--	--	--	--	--

TABLE - 11

FREQUENCY AND PERCENTAGE OF SCORES OPTAINED ON VERBAL ACTIVITIES OF T.T.C.T.

	ACTIVITY 3						ACTIVITY 4						ACTIVITY 5				ACTIVITY 6					
	Fl		Fx		Or		Fl		Fx		Or		Fl		Or		Fl		Fx		Or	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
0					178	17.3					165	16.1			019	01.9			088	08.6	092	09.0
1	004	00.4	016	01.6	430	41.9	001	00.1	0017	01.7	434	42.3	003	00.3	109	10.6	005	00.5	355	34.6	136	13.3
2	004	00.4	085	08.3	231	22.5	012	01.2	101	09.8	270	26.3	006	00.6	195	19.0	024	02.3	299	29.1	206	20.1
3	008	00.8	187	18.2	127	12.4	025	02.4	149	14.5	119	11.6	017	01.7	187	18.2	052	05.1	155	15.1	165	16.1
4	030	02.9	272	26.5	049	04.8	055	05.4	179	17.4	030	02.9	027	02.6	189	18.4	092	09.1	086	08.4	147	14-3
5	064	06.2	222	21.6	007	00.7	085	08.3	222	21.6	007	00.7	048	04.7	127	12.4	134	13.1	033	03.2	118	11.5
6	079	07.7	144	14.0	002	00.2	107	10.4	185	18.0	001	00.1	092	09.0	122	11.9	165	16.1	005	00.5	071	06.9
7	097	09.5	053	05.2	002	00.2	103	10.0	088	08.6			099	09.6	033	03.2	095	09.3	003	00.3	055	05.4
8.	126	12.3	033	03.2			111	10.8	048	04.7			096	09.4	027	02.6	084	08.2			025	02.4
9	144	14.0	011	01.1			142	13.8	026	02.5			151	14.7	012	01.2	118	11.5			010	01.00
10	124	12.1	003	00.3			071	06.9	007	00.7			134	13.1	005	00.5	073	07.1	001	00.1	001	00.1
11	107	10.4					118	11.5	003	00.3			129	12.6	001	00.1	085	08.3	001	00.1	000	00.00
12	099	09.6					074	07.2	001	00.1			088	08.6			056	05.5				
13	042	04.1					050	04.9					050	04.9			020	01.9				
14	043	04.2					033	03.2					041	04.00			011	01.1				
15	029	02.8					022	02.1					023	02.2			009	00.9				
16	015	01.5					014	01.4					015	01.5			002	00.2				
17	006	00.6					003	00.3					002	00.2			001	00.1				
18	003	00.3											002	00.2								
19	001	00.1											001	00.1								
20	001	00.1											001	00.1								
21													001	00.1								

verbal creativity and non-verbal creativity.

Non verbal creativity: The non-verbal parto of the test of creative thinking includes two activities, namely, parrellel lines and picture completion. Both the activities were scored for fluency, flexibility and originality. The data is organised in the form of frequency distribution which is shown in Table II.

In case of activity I, flency scores range from 1 to 23, flexibility from 0.to 21 and originality. But in case of activity II, these ranges are 0 to 10 for fluency and flexibility scores, and 0 to 15 for originality scores.

Verbal creativity: There are four activities in this part. These are, product improvement, unusual uses, unusual questions and just suppose. These activities were scored for fluency, flexibility and originality. Table III shows the frequency distributions and percentage of the sample in respect of each of these activities.

Table III clearly evinces that the range of fluency scores is slightly wider for activities III and V than for activities IV and VI.

TABLE NO. IV

FREQUENCY DISTRIBUTION AND PERCENTAGE OF SCORES OBTAINED IN MATHEMATICS

	CONCRETE		TRANSIT-IONAL		FORMAL		TOTAL SAMPLE		URBAN		RURAL		BOYS		GIRLS	
RANGE	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
31-40	54	20.5	009	01.7	001	00.4	064	06.2	053	05.9	011	08.2	030	04.6	034	09.2
41-50	77	29.3	043	08.3	002	00.8	122	11.9	090	10.1	032	23.9	078	11.9	044	11.9
51-60	90	34.2	142	27.4	019	07.8	251	24.5	207	23.2	044	32.8	155	23.6	096	25.9
61-70	37	14.1	205	39.6	048	19.6	290	28.3	255	28.6	035	26.1	191	29.1	099	26.8
71-80	05	01.9	101	19.5	103	42.0	209	20.4	198	22.2	011	08.2	135	20.6	074	20.0
81-90	00	00.0	017	03.3	056	22.9	073	07.1	072	08.1	001	00.7	053	08.1	020	05.4
91-100.	00	00.0	001	00.2	016	06.5	017	01.7	017	01.9	000	00.0	014	02.1	003	00.8
TOTAL	263	100	518	100	245	100	1026	100	892	100	134		656		370	

Achievement Scores

The achievement scores of the students in mathematics, science and agregate marks of all subjects at the Boards examination at class X level collected for the follwoing three classifications (i) levels of intellectual development, (ii) location of the sample (rural and urban) and (iii) sex(boys and girls).

These are presented subject-wise as below

Mathematics: The obtained data pertaining to the achievement in mathematics is provided as per the aforesaid classifi classification in table IV. The mean scores for boys a and girls are 64.18 and 62.09 respectively while that of rural and ruban groups are 56.81 and 64.42 respectively. For concrete stage the mean score is 51.30 while for transitional and formal levels are 63.72 and 75.83 represent graphical representation for the above mentioned distribution has also been attempted in the form of frequency polygon as shown in figure No. As evident from the graph, the nature of distributions of scores in mathematics for boys, girls, rural and urban samples seems to be normal. Distribution of scores for concrete level appears to be positively skewed while those for the transitional and formal levels of intellectual development the distributions tend to be negatively skewed.

TABLE - V

FREQUENCY DISTIRBUTION AND PERCENTAGE OF SCORES
OBTAINED IN SCIENCE

	CONCRETE		TRANSTIONAL		FORMAL		TOTAL SAMPLE		URBAN		RURAL		BOYS		GIRLS	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
31-40	018	06.8	010	01.9	001	00.4	029	02.8	025	02.8	004	03.0	022	03.4	007	01.9
41-50	153	58.2	083	16.0	001	00.4	237	23.1	185	20.7	052	28.8	151	23.0	086	23.2
51-60	079	30.0	192	37.1	018	07.3	289	28.2	242	27.1	047	35.1	174	26.5	115	31.1
61.70	010	03.8	207	40.0	098	40.0	315	30.7	287	32.2	028	20.9	199	30.3	116	31.4
71-80	001	00.4	025	04.8	103	42.0	129	12.6	126	14.1	003	02.2	089	13.6	040	10.8
81-90	000	00.0	000	00.0	022	09.0	022	02.1	022	02.5	000	00.0	018	02.7	004	01.1
91-100	002	00.8	001	00.2	002	00.8	005	00.5	005	00.6	000	000	003	00.5	002	00.5
TOTAL	263		518		245		1026		892		134		656		370	

Science : Table V shows that the range of scores in science achievement is 31-100 and these distribution for all calssifications are unimodel . The moders for both sexes total sample and also for urban students lie n in the class interval 61-70 while for ru al sample it falls in the class interval 51.60. The modes of science achievement scores for concrete, transitional and formal level students lie in class intervals 41-50, 61-70, 71-80 respectively. The mean scores for rural and urban groups are 60.74 and 54.54 respectively, while for boys and girls are 59.98 and 59.83 respectively. The mean score is for formal stage is higher than the other two stages.

Graphical representation for the above mentioned distribution has also been attempted in the form of frequency polygon in figure No.   The nature of distributions for urban, rural, boys and girls, as locks from the graph, is near normal. Distribution for concrete level is positively skewed while for the transitional and formal levels of intellectual development **the distribution tend to be negatively skewed.**

Aggregate achievement : Table VII represents the aggregate achievement scores ranged from 151 to 425. The nature of frequency distributions is unimodal.

TABLE - VI

FREQUENCY DISTRIBUTION AND PERCENTAGES OF AGGREGATE ACHIEVEMENT SCORES

RANGE	CONCRETE		TRANST-		FORMAL		TOTAL SAMPLE		URBAN		RURAL		BOYS		GIRLS	
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
151-175	00	0.00	000	0.0	001	00.4	001	00.1	001	00.1	00	00.0	00	0.0	001	0.3
176-200	026	09.9	002	00.4	001	00.4	029	02.8	024	02.7	005	03.7	019	2.9	010	2.7
201-225	090	34.2	016	03.1	001	00.4	107	10.4	080	09.0	027	20.1	064	9.8	043	11.6
226-250	059	22.4	047	09.1	001	00.4	107	10.4	088	09.9	019	14.2	062	9.5	045	12.2
251-275	047	17.9	097	18.7	004	01.6	148	14.4	123	13.8	025	18.7	096	14.6	052	14.1
276-300	030	11.4	160	30.9	014	05.7	204	19.9	168	18.8	036	26.9	131	20.0	073	19.7
301-325	010	03.8	116	22.4	051	20.8	177	17.3	160	17.9	017	12.7	107	16.3	070	18.9
326-350	001	00.4	046	08.9	042	17.1	089	08.7	086	09.6	003	02.2	062	9.5	027	7.3
351-375	000	00	026	05.0	066	26.9	092	09.0	090	10.1	002	01.5	054	8.2	038	10.3
376-400	000	00	008	01.5	053	21.6	061	05.9	061	06.8	000	000	050	7.6	011	3.0
401-425	000	00	000	00.0	011	04.5	011	01.1	011	01.2	000	000	011	1.7	00	00

The means scores for boys and girls are 295.24 and 286.81 while for rural and urban 263.94 and 296.44 respectively. The modes for total sample urban and rural, and for both sexes fall in the interval 276-300. The modes for concrete, transitional and formal levels thinkers fall in 201-225, 276-300 and 351-375 respectively.

The graphical representation for the above distribution has also been attempted in the form of . frequency polygon in fig. No. Graph shows normal distributions for total population, urban and rural sample, and also for both sexes. Distribution for concrete level is positively skwed while those for formal and transitional levels tend to be negatively skewed.

Socio-economic Status

Fathers' education, mothers' education, fathers occupation, mothers' occupation, parents imcome and family size of total population comprising urban and rural students at defferent levels of intellectual development have been organized under the following headings;

Education : Education of parents of the students have been classified into seven categories with weightage mentioned against each category as given below

TABLE - VII

SHOWING THE EDUCATIONAL LEVEL OF FATHERS

EDUCATION CATEGORY	TOTAL SAMPLE		URBAN								RURAL							
			CONCRETE		TRANSITIONAL		FORMAL		TOTAL		CONCRETE		TRANSITIONAL		FORMAL		TOTAL	
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
1	13	01.3	03	0.3	01	0.1	00	00	04	0.4	03	2.2	06	4.5	00	0.0	09	6.7
2	13	01.3	02	0.2	01	0.1	00	0.0	03	0.3	07	5.2	03	2.2	00	0.0	10	7.5
3	32	03.1	07	0.8	06	0.7	01	0.1	14	1.6	09	6.7	09	6.7	00	0.0	18	13.4
4	163	15.9	38	04.3	70	07.8	14	01.6	122	1.37	15	11.2	21	15.7	05	3.7	41	30.6
5	111	10.8	29	03.3	51	05.7	10	01.1	90	10.1	06	4.5	14	10.4	01	0.7	21	15.7
6	403	39,3	82	09.2	205	23.0	93	10.4	380	42.6	07	5.2	12	9.0	04	3.0	23	17.2
7	291	28.4	49	05.5	115	12.9	115	12.9	279	31.3	06	4.5	04	3.0	02	1.5	12	09.0
TOTAL	1026	100	210	23.5	449	50.3	233	26.1	892	100	53	39.6	69	51.5	12	9.0	134	100

TABLE - VIII

SHOWING THE EDUCATION LEVEL OF MOTHERS

EDUCATION CATEGORY	TOTAL SAMPLE		URBAN								RURAL							
			CONCRETE		TRANSITIONAL		FORMAL		TOTAL		CONCRETE		TRANSITIONAL		FORMAL		TOTAL	
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
1	218	21.2	053	5.9	069	7.7	12	1.3	134	15.5	30	22.4	49	36.6	05	3.7	64	62.7
2	063	6.1	015	1.7	026	02.9	07	0.8	48	5.4	08	6.0	04	3.0	03	2.2	15	11.2
3	089	8.7	021	2.4	040	04.5	11	1.2	72	8.1	07	5.2	08	6.0	02	1.5	17	12.7
4	248	24.2	060	6.7	125	14.0	53	5.9	238	26.7	05	3.7	04	3.0	01	0.7	10	7.5
5	099	9.6	020	2.2	050	05.6	25	2.8	095	10.7	01	0.7	02	1.5	01	0.7	04	3.0
6	248	24.2	035	3.9	119	13.3	92	10.3	246	27.6	01	0.7	01	0.7	00	0.0	02	1.5
7	61	5.9	006	0.7	020	02.2	33	3.7	059	06.7	01	0.7	01	0.7	00	0.0	02	1.5
	1026	100	210	23.5	449	50.3	233	26.1	892	100	53	39.6	69	51.5	12	9.0	134	100

S.No.	Categories	Weightage
i.	Profession degree, master's degree and above.	7
ii.	B.A. or B.Sc. degree	6
iii.	Intermediate or Post High School diplomas	5
iv.	High School or its equivalent	4
v.	Completion of full course of elementary education or Middle school.	3
vi	Literacy or elementary schools for few years.	2
vii	Illiterate	1

Educational status of fathers of the students varied from illiterste to professional degree holders and above in the total sample and also in case of urban and rural students. The majority, fathers of urban students and of total sample subjects, as shown in Table VII were graduate then professional and then only possessed certificates. In case of rural students this order was as follows, high schools (I), graduates (II) and intermediate (III).

Educational status of mothers of students also varied from illiterate to having masters degree, professional degree and above in the total sample.

and urban and rural sample. As shown in Table VIII majority of mothers of the total sample were graduates and an equal number of mothers were high school passed. This is followed by those who possessed letterprofessional degrees or master's degrees and above in case of urban sample the order is more or less same as in the total same But it is interesting to rote that majority of mothers in rural sample were having either professional degree or master's degree followed by intermediates post high school deploma holders.

Occupation : Occupation of the parents of the students have been classified into eight categories. Categories with weightage mentioned against each are as follows

S. No.	Category	Weightage
I	Higher professions like engineering medicine, law administration etc.	7
ii	Semi professional	6
iii	Clerk, shopkeeper, farm owner	5
iv	Skilled worker	4
v	Semi-skilled worker	3
vi	Un-skilled worker- domestic servant, farm labour, casual labourer.	2
vii	Unemployed, dependent, beggar, vagrant	1
viii	Dead (not alive)	0

TABLE - IX

SHOWING THE OCCUPATION STATUS OF FATHERS

EDUCATION CATEGORY	TOTAL SAMPLE		URBAN								RURAL							
			CONCRETE		TRANSITIONAL		FORMAL		TOTAL		CONCRETE		TRANSITIONAL		FORMAL		TOTAL	
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
0	11	1.1	02	0.2	06	0.7	03	0.3	11	1.2	00	0.0	00	0.0	00	0.0	00	0.0
1	05	0.5	01	0.1	00	0.0	00	0.0	01	0.1	03	2.2	01	0.7	00	0.0	04	3.0
2	33	3.2	04	0.4	06	0.7	02	0.2	12	1.3	09	6.7	12	9.0	00	0.0	21	15.7
3	29	2.8	03	0.3	11	1.2	00	0.0	14	1.6	11	8.2	04	3.0	00	0.0	15	11.2
4	42	4.1	09	1.0	19	2.1	01	0.1	29	3.3	05	3.7	06	4.5	02	1.5	13	9.7
5	426	41.5	107	12.0	207	23.2	57	6.4	371	41.6	15	9.7	35	26.1	07	5.2	55	41.0
6	276	26.9	60	6.7	125	14.0	66	7.4	251	26.1	12	9.0	10	7.5	03	2.2	25	18.7
7	204	19.9	24	2.7	75	8.4	104	11.7	203	22.8	00	0.0	01	0.7	00	0.0	01	0.7

TABLE - X

SHOWING OCCUPATION STATUS OF MOTHERS

CATE-GORY	TOTAL SAMPLE		URBAN								RURAL							
			CONCRETE		TRANST-IONAL		FORMAL		TOTAL		CONCRETE		TRANST-IONAL		FORMAL		TOTAL	
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
0	06	0.6	0	0.0	03	0.3	01	0.1	04	0.4	02	3.8	00	0.0	00	0.0	02	1.5
1	855	83.3	193	21.6	387	43.4	151	16.9	731	82.0	046	86.8	66	95.7	12	100	124	92.5
2	03	0.3	00	0.0	00	0.0	01	0.1	01	0.1	001	01.9	01	01.4	00	0.0	02	1.5
3	04	0.4	00	0.0	03	0.3	01	0.1	04	0.4	-	-	-	-	00	0.0	00	0.0
4	13	1.3	01	0.1	03	0.3	07	0.8	11	1.2	0.01	01.9	01	01.4	00	0.0	02	1.5
5	30	2.9	04	0.4	17	1.9	07	0.8	28	3.1	002	03.8	00	0.0	00	0.0	02	1.5
6	112	10.9	12	1.3	35	3.9	63	7.3	110	12.3	001	01.9	01	01.4	00	0.0	02	1.5
7	03	0.3	00	0.0	01	0.1	02	0.2	03	0.3	-	-	-	-	-	-	-	-

Occupational status of fathers' of the students ranged from unemployed dependent, vagrant to higher prefessionals like engineers, doctors, administrators etc. The order of the fathers' occupation of total sample and urban sample as presented in Table IX was category 5,6,7 i.e. clerks, shopkeepers etc. at first place, Semi professions at the second place and higher professions a at the third place . In case of rural students the order was slightly changed, farm owner/shopkeeper taking the first place semi-professions at second, and un-skilled workers farm labour etc at the third place.

Students mothers' occupation status varied from dependent to higher professions. The order in which the mothers' occupation of total population and urban students occured is shown in Table X. It is evident from the table that most of the mothers were simply house wives follwed by semi professional at clerks etc at the third place.

In case of rural students' mothers' majority of them were dependents followed by all others categories (3,4, 5, 6) at second place.

Parents' income

Permonth income of students parents have been grouped into ranges (501-1000) to (9501-10,000) which is shown in table XI The mean income for total sample, urban and rural samples are 2234.37, 2359.32 and 1402.61 respectively. The medians of income of parents belonging to concrete, t ansitional and formal operation levels are 1724.52, 2090.56 and 3085.71 respectively.

The graphical representation for the above mentioned distribution, as drawn in figure No. shows a negatively

TABLE - XII

SHOWING PARENTS' INCOME

RANGE	LEVELS OF INTELLECTUAL DEVELOPMENT								LOCATION			
	CONCRETE		TRANSIT-IONAL		FORMAL		TOTAL		URBAN		RURAL	
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
501-1000	51	19.4	43	8.3	05	02.0	099	9.6	055	06.2	044	32.8
1000-1500	86	32.7	118	22.8	24	09.8	227	22.2	186	20.9	042	31.3
1501-2000	66	25.1	150	29.0	39	15.9	255	24.9	220	24.7	035	26.1
2001-2500	28	10.6	097	18.7	31	12.7	156	15.2	149	16.7	007	05.2
2501-3000	15	05.7	049	09.5	35	14.3	099	09.6	095	10.7	004	03.0
3001-3500	12	04.6	032	06.2	49	20.0	093	09.1	092	10.3	001	00.7
3501-4000	03	01.1	014	02.7	23	09.4	040	03.9	039	04.4	001	00.7
4001-4500	02	00.8	06	01.2	16	06.5	024	02.3	024	02.7	000	000
4501-5000	00	0.0	06	01.2	07	02.9	013	01.3	013	01.5	000	000
5001-5500	00	0.0	02	0.4	05	02.0	007	00.7	007	00.8	000	000
5501-6000	00	0.0	00	00	04	01.6	004	00.4	004	00.4	000	000
6001-6500	00	0.0	01	0.2	01	00.4	002	00.2	002	00.2	000	000
6501-7000	-	-	-	-	-	-	-	-	-	-	-	-
7001-7500	00	0.0	00	0.0	03	01.2	003	00.3	003	00.3	000	000
7501-8000	00	0.0	00	0.0	01	00.4	001	00.1	001	00.1	000	000
8001-8500	-	-	-	-	-	-	-	-	-	-	-	-
8501-9000	-	-	-	-	-	-	-	-	-	-	-	-
9001-9500	00	0.0	00	0.0	02	00.8	002	00.2	002	00.2	000	000

showed distributions.

Size of the family: family size of the students varied from three members to twelve members. In the total sample and the urban students sample the size of the family as shown in the Table XII was in the order of five members six members followed by four members. In case of rural students this order is six members, seven members followed by eight members family. Average family size of urban students at concrete, transitional and formal levels of intellectual development was found six, five and five respectively. In case of rural students at concrete, 'r transitional and formal levels of intellectual development the size of family rests in order of seven , six, and six respectively, which is higher than the urban sample at the same level of intellectual development.

TABLE - XIII

SHOWING THE SIZE OF THE FAMILY

MEMBE-RS	TOTAL SAMPLE		URBAN								RURAL							
	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
			CONCRETE		TRANST-IONAL		FORMAL		TOTAL		CONCRETE		TRANST-IONAL		FORMAL		TOTAL	
3	23	2.2	04	0.4	09	1.0	09	1.0	22	2.5	00	0.0	01	0.7	00	0.0	01	0.7
4	171	16.7	27	3.0	72	8.1	64	7.2	163	18.3	04	3.0	03	2.2	01	0.7	08	6.0
5	321	31.3	66	7.4	151	16.9	84	9.4	301	33.7	06	6.0	11	8.2	01	0.7	20	14.9
6	275	26.8	68	7.6	126	14.1	48	5.4	242	27.1	12	9.0	16	11.9	05	3.7	33	24.6
7	130	12.7	29	3.3	56	06.3	16	1.8	101	11.3	23	9.7	15	11.2	01	0.7	29	21.6
8	059	5.8	09	1.0	21	02.3	07	0.8	036	4.1	08	6.0	12	9.0	02	1.5	22	16.4
9	032	3.1	04	0.4	10	01.1	03	0.3	017	1.9	07	5.2	07	5.2	01	0.7	15	11.2
10	009	0.9	01	0.1	02	00.2	01	0.1	004	0.4	00	0.0	04	3.0	01	0.7	05	3.7
11	003	0.3	01	0.1	01	00.1	00	0.0	002	0.2	01	0.7	00	0.0	00	0.0	01	0.7
12	003	0.3	01	0.1	01	00.1	01	0.1	03	0.3	00	0.0	00	0.0	00	0.0	00	0.0

ANALYSIS AND INTERPRETATION OF DATA

In pursuance of the research hypotheses formulated under for this study, the data were analysed in order to study the relationship and significance of difference amongst the groups with reference to variables studied. The whole analysis and interpretation has been presented in three main parts namely:

(i) Level of Intellectual Development

(ii) Relationship

(iii) Difference

The scheme of the analysis and interpretation is as mentioned below:

TOTAL SAMPLE

URBAN		RURAL	
GENERAL STUDENTS	SC/ST STUDENTS	GENERAL STUDENTS	SC/ST STUDENTS

TOTAL SAMPLE

URBAN				RURAL			
Government		Aided		Government		Aided	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls

Since there were no aided schools for girls in rural areas, therefore a comperative study of girls

of Government schools and aided schools could not be made. Before proceding further it would be desireable to remind ourselves that the average age of the sample subjects is sixteen (16.).

LEVEL OF INTELLECTUAL DEVELOPMENT.

As discussed earlier, Jean Piaget, the chief advocate of Geneva school has propounded four stages of the development of intellect begining from birth untill 15 years of age. According to this school of thought, all adolescents must attain the formal operational thinking stage. Therefore, it was considered necessary, before probing further, to assess, the actual levels of intellectual attainment of the sample.

In the present study Group Assessment of Logical Thinking (GALT) was used to classify the sample into three levels of intellectual development. The proportions of science adolescent students reaching at concrete, transitional and formal operational level of intellectual development have been computed in percent and are presented in Table No. to

Levels of Intellectual Development of Students

Table No. present an overall view of the levels of intellectual development of boys and girls of Urban and Rural areas and total sample. The table shows that:

(i) Only 23.9% students of the total sample were found at formal operational level, 50.5% at transitional level and remaining 25.6% still at concrete operational level.

(ii) In urban group 26.1% , 50.3% and 23.5% and in rural group 09%, 51.5% and 39.6% were at formal, transitional and concrete operational level of intellectual development respectively.

(iii) At formal and transitional levels percentage of girls was slightly higher than the percentage of boys. At formal and transitional levels 23.16% and 49.69% boys were found as against the percentage of girls 25.13% and 51.89% at formal and transitional level of intellectual development. At concrete level girls percentage was slightly less than that of boys i.e. 22.97% against 27.13%

(iv) In urban areas percentage of boys at formal and concrete level were higher than that of

TABLE : XIII

FREQUENCY AND PERCENTAGE OF STUDENTS AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT

GROUPS	N	LEVELS OF INTELLECTUAL DEVELOPMENT					
		CONCRETE		TRANSITIONAL		FORMAL	
		Fq	%	Fq	%	Fq	%
TOTAL SAMPLE	1026	263	25.60	518	50.50	245	23.90
URBAN	892	210	23.50	449	50.30	233	26.10
RURAL	134	053	39.60	069	51.50	012	09.00
BOYS	656	178	27.13	326	49.69	152	23.16
GIRLS	370	085	22.97	192	51.89	093	25.13
URBAN BOYS	530	131	24.70	259	48.80	140	26;40
URBAN GIRLS	362	079	21.80	190	52.50	093	25.70
RURAL BOYS	126	047	37.30	067	53.20	012	09.50
RURAL GIRLS	008	006	75.00	002	25.00	NIL	NIL

girls at the same level. Percentage of boys at formal and transitional level were 26.4% and 24.7% as against the percentage of girls 25.7% and 21.8% at the formal and concrete level of intellectual development. At transitional level percentage of girls was slightly higher against the percentage of boys(52.8% against 48.8%.)

In rural group; out of eight girls not a single girl could reach at formal level of intellectual development. The percentage of boys at formal level was found to be 09.50% only. At concrete and transitional level of intellectual development percentage of boys were found 37.3% and 53.2% against the percentage of girls 75.0% and 25% respectively.

nce above observations shows following trends;

-Formal operational level was not attained by majority of the adolescent science students.

- Majority of the students are at transitional level of intellectual development.

- In urban group percentage of students at formal operational level was higher than

their counterparts in rural areas.

- Percentages of concrete operational thinker students was higher in rural areas than that of urban areas.

- In urban and rural groups percentage of boys at formal level was found slightly higher against their girls counterparts. However in total sample percentage of girls was slightly higher than that of boys.

- At transitional operational level of intellectual development percentage of girls was slightly higher against boys in urban and total sample. However, higher percentage of boys was found in case of rurol sample.

Thus the hypotheses which states that:

"Majority of the science adolescent students are at formal operational level of intellectual development" is rejected.

This finding gives strength to other findings where majority of students belong to concrete and transitional operational level and only few in formal operational level, that is, majority of students

do not reache at formal operational level of thinking (Elkind, 1962; Jackson, 1965; Allovell, 1966; Peterson, 1970; Dale, 1970; Karplus, 1970; Mackinnon and Renner, 1970; Dulit, 1972; Renner and Staford, 1972; Nordland, 1974; Lawson et.al. 1974, 1975, 1977; Chiappetta, 1974; Sayer and Ball, 1975; Vaidya, 1975; 1978, 1981; Wollmanet.al. 1976; Kanskar, 1979; Sandhu, 1980, Mathur, 1981; and Kumar, 1982).

Intellectual Development of Students of Government and Aided Schools:

The proportions of students readhing at concrete transitional and formal levels of intellectual development in government and aided schools of both sexs (boys and girls) belonging to urban and rural areas have been presented in table No. XIV.

The table XIV, shows that: (i) percentage of students reaching at concrete operation level of both in government and aided schools were nearly the same. In aided schools the percentage of students at formal level was higher than that of students studying in government schools, 28.22% and 21.40% respectively. At transitional operational stage the percentage of students of government schools was higher than that of aided schools

TABLE : XIV

FREQUENCY AND PERCENTAGE OF STUDENTS AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT OF GOVERNMENT AND AIDED SCHOOLS

	LEVELS OF INTELLECTUAL DEVELOPMENT						
		CONCRETE		TRANSITIONAL		FORMAL	
GROUPS	N	Fq	%	Fq	%	Fq	%
GOVERNMENT SCHOOL	654	168	25.68	346	52.90	140	21.40
AIDED SCHOOLS	372	95	25.53	172	46.23	105	28.22
URBAN GOVERNMENT SCHOOLS	543	125	23.02	286	52.66	132	24.30
URBAN AIDED SCHOOLS	249	85	34.13	163		101	40.56
RURAL GOVERNMENT SCHOOLS	111	43	38.73	60	54.05	8	7.20
RURAL AIDED SCHOOLS	23	10	43.47	9	39.13	4	17.39

(52.90% against 46.23%). (ii) In both urban and rural groups percentages of the students reaching at concrete and formal operation levels were higher in case of aided schools students than that of government school students. But at transitional operation level percentages were higher for government school students than their counterparts both in urban and rural groups

Table XIV, also provides frequency and percentages of boys and girls of government and aided schools of urban and rural areas. Table reveals that : (i) In urban and rural areas percentages of boys of aided schools reaching at formal and concrete levels were higher against boys of government schools. In urban areas the percentages of boys of aided and government schools at formal and concrete level were 31.3% and 23.1% and 28.5% and 22.2%, at concrete level respectively. At transitional operational level percentage of boys was higher in government schools than that of aided schools (ii) In case of girls of urban areas percentages of girls of government schools reaching at concrete and formal operational levels were found more 24.2% and 26.0% against aided schools, 25.2% and 17.8%, respectively. However, the trend was found to be reverse in case of girls reaching at transitiona operational level i.e. percentage of girls of aided schools exceeded their

government schools counterparts, (57% against 49.8%) .

It may be concluded from the above observation that :

- learning environment of aided schools facilitate more to students to attain formal operational level of intellectual development than that of government schools.
- learning environment of government schools was facilitating more to girls to attain formal operational level than that of aided schools in urban areas.
- boys of aided schools were found in advantageous position to attain formal operational level against boys studying in government schools in urban and rural settings.
- percentages of boys reached at concrete operational level of intellectual development was higher in case of aided schools against government schools in both urban and rural areas. Reverse in trend was observed for girls of urban setting.
- percentage of boys at transitional operational level was higher in government schools than that aided schools. While reverse was true for girls in urban areas.

TABLE : XV

FREQUENCY AND PERCENTAGE OF GENERAL AND SC/ST STUDENT AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT

		LEVELS OF INTELLECTUAL DEVELOPMENT					
		CONCRETE		TRANSITIONAL		FORMAL	
GROUPS	N	Fq	%	Fq	%	Fq	%
GENERAL CATEGORY	942	236	25.05	470	49.89	236	25.05
SC/ST CATEGORY	84	27	32.14	48	57.14	9	10.71
URBAN GENERAL CATEGORY	832	190	22.80	417	50.10	225	27.00
URBAN SC/ST CATEGORY	60	20	33.30	32	53.30	8	13.30
RURAL GENERAL CATEGORY	110	46	41.80	53	48.20	11	10.00
RURAL SC/ST CATEGORY	24	7	29.20	16	66.70	1	4.20

So on the basis of above findings the hypotheses which states:

> "Percentages of Both Sexes Different Levels of Intellectual Development Are Equal in Government and Aided Schools,"
>
> is not accepted.

Intellectual Development of General and SC/ST Students

Table XV, shows level of intellectual development of general and SC/ST students of urban, rural and total sample. Following trends may be onserved from the Table XV : (i) percentage of general students at formal operation level was higher against SC/ST students in urban, rural and total sample. (ii) percentage of SC/ST students at concrete and transitional operation levels were higher than general students in urban area and total sample. (iii) percentage of genral students at concrete operational level was higher than that of SC/ST students in rural sample.

Thus on the basis of above findings the hypotheses which states that:

> "Percentage of both General and SC/ST Categories Students are Equal at Different Levels of Intellectual Development",

is not accepted.

R E L A T I O N S H I P
OF
INTELLECTUAL DEVELOPMENT WITH CREATIVITY

Relationship Between Intellectual Development

An assessment of level of intellectual development was made by scores on Group Assessment of Logical Thinking Test. The same test was also used for classifying the sample into concrete, transitional and formal operational level thinkers. Creativity was asscertained through Torrance Test of creative thinking. This test yielded separate scores for verbal and non-verbal fluency, flexibility and originality. Also provided by the test are non-verbal creative thinking scores, verbal creative thinking scores, total fluency (fluency scores of non-verbal + verbal tests) total flexibility, total originality and creative thinking scores. The raw scores of different components of non-verbal and verbal creative thinking were scaled into T-scores before subjecting them to addition. An attempt has been made to study the relationship between creaticity and intellectual development. Pearson's product moment correlation method was employed for obtaining the coefficient of correlation for bivariate distributions.

The obtained results have been reported in Table XVI to X .

TABLE - XVI

CORRELATION COEFFICIENTS BETWEEN VARIOUS COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF THE STUDENTS

COMPONENTS OF CREATIVITY	TOTAL SAMPLE	INTELLECTUAL DEVELOPMENT		
		CONCRETE LEVEL	TRANSITIONAL LEVEL	FORMAL LEVEL
	r	r	r	r
NV Fl	0.371**	0.177**	0.194**	0.227**
NV Fx	0.445**	0.254**	0.160**	0.258**
NV Or	0.656**	0.190**	0.232**	0.479**
NVC Tot.	0.560**	0.237**	0.234**	0.381**
V Fl	0.530**	0.257**	0.236**	0.428**
V Fx	0.546**	0.236**	0.164**	0.441**
V Or	0.734**	0.428**	0.364**	0.534**
VC Tot.	0.672**	0.352**	0.295**	0.519**
Fl	0.536**	0.265**	0.259**	0.410**
Fx	0.577**	0.264**	0.200**	0.441**
Or	0.779**	0.433**	0.307**	0.583**
Total Creative	0.697 **	0.357**	0.320**	0.524**

* - .05,
** - .01 Level of significance

Creativity And Intellectual Development of Students

A look at table XVI reveals that creativity and intellectual development were found to be positively correlated, Correlations for various components of creativity and levels of intellectual development ranged from a very low (0.160) to high (0.779) which were significant at .01 level of significance. The following may be inferred on the basis of the obtained results:

(i) Correlations between creativity and levels of intellectual development seem to follow a pattern of being at a low ebb at concrete level, getting shrinked at transitional stage and showing a spurious growth at formal level. This holds good for both verbal and non-verbal creativity and their total and also for further components namely fluency, flexinility and originality.

(ii) Creativity components namely, fluency, flexibility and originality were found to show higher relationship at formal level of intellectual development as compared to other two levels. The component of verbal creativity superceeded their non verbal counterparts in demonstrating the relationship at formal level. Rate of increase in correlation coefficients was maximum in case of fluency followed by flexibility with a minimum for originality;

when verbal and non-verbal creativity were taken together.

(iii) Components of verbal creativity and total creativity indicate almost similar trend of relationship with formal operational level of intellectual development and the components of non-verbal creativity appear to lag behind.

The above mentioned observations lead one to believe that intellectual development goes hand in hand with the development of creative thinking. At transitional stage, it gets a jerk that may be due to the development of thinking under internal conflict which perhaps does not get an expression for want of clarity. It ultimately reaches its peak at formal level and creative expression flows out. Rate of growth of fluency seems to be higher than flexibility. Besides this, growth of originality at formal level seems to take place at some what low pace. Non-verbal expressions lag behind verbal expression at formal level since non-verbal expression apparantly requires relatively more imagination.

On the basis of above findings the hypothesis

which states that :

> "There is no Significant Relationship
> Between Levels of Intellectual
> Development and Creativity;"

is rejected.

Creativity and Intellectual Development of Urban and Rural Students

Coefficient of correlation computed for components of non-verbal, verbal and total creativity scores with intellectual development scores of urban and rural students have been presented in Table XVII. All coefficients of correlation were found to be positive and significant at 0.1 levels excepting one between intellectual development (of urual students) and non-verbal fluency scores, which indicated positive relationships significant at .05 level. The range of correlation coefficients has been from 0.156 to 0.780. The following may be infered from table observations :

(i) Intellectual development of urban students was relatively more positively associated with various component of non-verbal, verbal and total creativity as against their rural counterparts.

TABLE -X VII

CORRELATION COEFFICIENTS BETWEEN VARIOUS COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF URBAN AND RURAL STUDENTS

	URBAN	RURAL
	N-892 'r'	N-134 'r'
NVFl	0.382**	0.156**
NV Fx	0.437**	0.293**
NV Or	0.653**	0.570**
NVC Tot.	0.566**	0.344**
V Fl	0.540**	0.283**
V Fx	0.544**	0.389**
V Or	0.732**	0.685**
VCN T	0.674**	0.517**
Fl	0.547**	0.274**
Fx	0.581**	0.394**
Or	0.780**	0.726**
Total Creative	0.704**	0.509**

** - .01 level of significance

(ii) Relatively closer relationship between intellectual development and components of verbal creativity may be seen as compared to relationships between intellectual development and components of non-verbal creativity for both rural and urban students.

(iii) Fluency, flexibility and originality components of non.verbal and verbal creativity were found to be related with intellectual development in an increasing order for both urban and rural students. i.e. minimum being with fluency and maximum with originality.

(iv) In case of urban students intellectual development was found to be highly related with total creativity. It was followed by the relationship with non-verbal creativity and with verbal creativity at minimum. However, in case of rural students this relationship was found to be maximum for verbal creativity followed by non-verbal creativity through total creativity.

The above mentioned observations lead us to believe that ruban students grew better than their rural counterparts in non.verbal, verbal and total creativity viz-a_viz intellectual development. It shows that urban students possibly think better both at herizontal and longitudinal levels. Slightly less magnitude of relationship of intellectual development with components

non-verbal creativity than components of verbal creativity may be attributable to the requirement of imagination for figural activities as against verbal activities. So on the basis of above findings it seems fair to say that intellectual development of urban and rural students was significantly related with various components of creativity. Thus the hypothesis which state that :

> "There is No Significant Relationship Between Intellectual Development and Creativity in Urban and Rural Sample;"

is rejected.

Creativity and Intellectual Development of Boys and Girls

Table XVIII shows that all coefficients of correlation between scores of intellectual development and various components of creativity of boys and girls ranged between 0.314 to 0.782. These were significant and .01 level of significance and represented low to very high positive relationships.

The magnitude of relationship of verbal and creativity with intellectual development in case of both boys and girls were observed to be in increasing in the

TABLE - XVIII

CORRELATION COEFFICIENTS BETWEEN VARIOUS COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS

			I.D.N. 1026	
	BOYS (656)		GIRLS (370)	
	r	Sign	r	Sign.
NV Fl	.314	.001	.481	.001
NV Fx	.412	-do-	.506	-do-
NV Or	.645	-do-	.689	-do-
NV Tot.	.526	-do-	.628	-do-
V Fl.	.512	-do-	.593	-do-
V. Fx.	.543	-do-	.543	-do-
V.Or.	.745	-do-	.727	-.do-
V. Tot.	.665	-do-	.697	-do.
Fl	.505	-do-	.617	-do-
Fx	.561	-do-	[illegible]	-do-
Or.	.752	-do-	.780	-do-
TOTAL Creative	.681	-do-	.732	-do-

following order : Non-verbal, verbal and total creativity.

Intellectual development of both boys and girls have been found to be associated with components of non-verbal creativity in order of fluency flexibility and originality. However, intellectual development of girls followed slightly changed pattern of relationship with components of verbal creativity and creativity, the order being flexibility, fluency followed by originality.

The Table XVIII further shows that the scores of intellectual development of girls were relatively better related to all the components of non-verbal and total creativity than that of boys.

The relationship of flexibility with intellectual development was found almost equal for both the sexes.

An examination of the extent of relationship of verbal components of creativity with intellectual development indicates that intellectual development appeared to be associated uniformaly with the flexibility of boys and girls, but fluency in case of girls and originality in case of boys were found to be more associated with intellectual development as against their respective counterparts.

The above observations gives rise to the following conclusions:

- intellectual development significantly contributes to the development of creativity amongst boys and girls.

- the influence of intellectual development was relatively more on creativity of girls as compared to boys in general, Originality (verbal) in boys and fluency (verbal) in girls exceeded respective counterparts with intellectual development while flexibility proceeded uniformly for both the sexes.

Thus on the basis of above finding the hypothesis which states that :

> "There is no Significant Relationship Between Creativity and Intellectual Development of Boys and Girls;"

is not accepted.

Creativity and Intellectual Development of Boys and Girls of Urban and Rural Areas.

Table XIX presents the coefficients of correlation between components of creativity and scores of intellectual development of boys and girls of urban and rural areas. These were found to be ranging from 0.126 to 0.893. The range for urban and rural sample, was from 0;335 to 0.788 and 0.126 to 0.893 respectively. In urban sample all coefficients of correlation were found to show positive relationship, significant at .01 level of significance. In case of rural boys, all soefficient of correlations, excepting one ((intellectual development V/S non-verbal fluency) were found to be positive and significant at .01 level While for girls of rural area the significant correlation were existed for verbal flexibility, verbal creativity at .05 level and for verbal originality and total originality at .01 level of significance.

The table XIX further indicates that scoresof intellectual development of both sexes in urban area were related with total verbal creativity, total non-verbal creativity and total creativity in increasing order from non-verbal to total creativity through verbal creativity. However, scores of intellectual

TABLE XIX

COEFFICIENTS OF CORRELATION BETWEEN VARIOUS COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS: LOCATIONWISE

COMPONENTS OF CREATIVITY	URBAN		RURAL	
	BOYS	GIRLS	BOYS	GIRLS
NV Fl	.335**	.467**	.126	.059
NV Fx	.409**	.488**	.261**	.354
NV Or	.642**	.687**	.586**	.389
NV Tot.	.538**	.620**	.326**	.256
V.Fl.	.541**	.579**	.265**	.372
V.Fx.	.545**	.538**	.410**	.690*
V.Or.	.748	.717**	.674**	.893**
V. Tot.	.674**	.687**	.512**	.700*
Fl.	.535	.604**	.247**	.266
Fx.	.575**	.596**	.387**	.612
Or.	.788**	.772**	.723**	.811**
Total Creative	.695**	.722**	.496**	.579

development of rural sample for both sexes were found to related with scores of creativity in increasing order from non-verbal ot verbal throgh total crativity,

In case of boys of both areas and girls of rural area, creativity components, namely, fluency, flexibility and originality were found to be related with intellectual development in an increasing order (i.e. minimum with fluency and maximum with originality). This also holds good for components of non-verbal creativity V/S intellectual development for girls of urban area. However, components of verbal creativity and total creativity for urban girls were found to be related to intellectual development in increasing order from originality to fluency to flexibility.

The table XIX further reveals that intelletual development of urban boys was slightly more associated to components of non-verbal, verbal and total creativity as against their rural counterparts. Similar type of relationship was observed for components of non-verbal creativity of girls.

From the above discussion the follwoing conclusions may be drawn :

- verbal creativity of subjects was more closely associated with intellectual development than non-verbal creativity irrespective of

their being in rural or urban schools.

- urban boys exceeded rural boys in the relationship of intellectual development with verbal, non-verbal and creativity.

- non-verbal and creativity ware more closely associated with intellectual development of urban girls as against rural girls. While reverse was the case with regards to verbal creativity.

Thus on the basis of above finding the hypothesis which states that:

> "There is no Significant Relationship Between Components of Creativity And Intellectual Development of Boys And Girls of Urban and Rural Areas;"

is rejected.

Creativity And Intellectual Development In Government And Aided Schools

After studying the extent of relationship between intellectual development and different component of creativity scores, the investigator was interested to find out the effect of shcooling i.e. government schools and government aided schools on intellectual development and creativity . Some of the recent studies(Lawson, 1975; Deluca, 1981) indicated the view that school environment has also contributed to the development of cognitive functioning of mind. But their findings regarding the effect of different types of schools on development and creativity were inconclusive. So, in the present study the types of schooling was found desirable to be studied. Correlation were computed between intellectual development and components of creativity.

Table XX indicates that all coefficients of correlation between components of creativity and intellectual development of students studying in government and aided schools ranged from 0.276 to 0.752 and 0.499 to 0.787; respectively. They represented low to high positive relationship, which were significant at .01 level of significance.

A close look on the table would reveal the

TABLE - XX

COEFFICENTS OF CORRELATIONS BETWEEN COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF STUDENTS OF GOVERNMENT AND AIDED SCHOOLS

COMPONENTS OF CREATIVITY	SCHOOLS	
	GOVT.	AIDED
NV Fl	.276**	.499**
NV Fx	.382**	.535**
NV Or.	.616**	.704**
NV Tot.	.488**	.653**
V Fl.	.434**	.653**
V.Fx.	.517**	.589**
V.Or.	.698**	.787**
V. Tot.	.615**	.742**
Fl.	.436**	.660**
Fx.	.540**	.633**
Or.	.752**	.819**
Total Creativity	.642**	.761**

following:

(i) Intellectual development of students studying in aided schools was found to have relatively more positive associated with various components of non.verbal, verbal and total creativity than their government school counterparts.

(ii) Verbal components of creativity were more closely related with intellectual development of students as against non-verbal components in both government and aided schools.

(iii) The extent of relationship between components of creativity and intellectual development of students was found to be maximum in case of originality in government and aided school. In government scholls it was followed by flexibility and fluency. In aided schools the minimum associateion was seen with fluency of non-verbal and flexibility of total creativity and

It seems appropriate to draw the following conclusions on the basis of above mentioned observations:

- learning environment of aided schools appears to provide relatively more facilities to students to grow intellectually and creatively, than the government institutions.

- the verbal components of creativity were found to be more associated with intellectual development as compared to non-verbal components of creativity in both kinds of schools (government as well as aided).

- increase in the level of intellectual development of students leads to a corresponding increase in originality component of creativity when compared to other two components.

Thus on the basis of above findings the hypothesis which states that:

> "There is no-Significant Relationship Between Intellectual Development of Students of Government And Aided Schools";

is rejected.

Creativity and Intellectual Development In Government And Aided Schools In Urban And Rural Locations

Table XXI shows, coefficients of correlation between components of creativity and intellectual development of students studying in urban and rural area were found to be ranging from 0.278 to 0.745 and 0.499 to 0.822. In urban government and aided schools and 0.132 to 0.745 and -0.052 to 0.757 in rural

TABLE XXI

COEFFICIENTS OF CORRELATION BETWEEN VARIOUS COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF GOVERNMENT AND AIDED SCHOOLS LOCATION WISE

COMPONENTS OF CREATIVITY	URBAN GOVT.	URBAN AIDED	RURAL GOVT.	RURAL AIDED
NV Fl.	.278**	.499**	.132	.352*
NV Fx.	.357**	.534**	.295**	.497**
NV Or.	.604**	.706**	.591**	.757**
NV Tot.	.487**	.655**	.338**	.569**
V. Fl.	.430**	.671**	.354**	(-).052
V. Fx.	.502**	.598**	.458**	.467*
V.Or.	.684**	.704**	.700**	.637**
Vr. Tot.	.603**	.757**	.572**	.372*
Fl.	.435**	.673**	.309**	.135
Fx.	.529**	.646**	.439**	.541**
Or.	.745**	.822**	.747**	.714**
Total Creativity	.637**	.774**	.545**	.497**

* - .05
** - .01 level of significance.

government and aided schools. Reported coefficients of correlation for urban schools were found to represent low to vary high positive relationships, significant at .01 level of significance.

The coefficients of correlation of rural schools represented very low to very high positive relationships significant at .05 level and .01 levels excepting for non-verbal fluency in government schools and total fluency in aided schools.

The following may be infered from the obtained results:

(i) Components of creativity were found to be more related with intellectual development of students studying in aided schools of urban area than their counterparts in aided schools of urual area.

(ii) Components of creativity indicated slightly higher association with intellectual development of students studying in government schools of urban area than their counterparts in rural schools. However, verbal originality was found to be slightly more associated by intellectual development in rural government schools.

(iii) In urban area, intellectual development of students studying in aided schools was found to be slightly more associated with components of creativity as against the students of government schools.

(iv) In rural area, mostly coefficients of correlation between intellectual development of the students of government schools and components of creativity were found slightly higher than that of aided schools. However, in rural area relationship between intellectual development and flexibility (verbal and total) werefound favoring students of studying in aided schools rather than the government ones.

(v) Increasing order of relationship of intellectual development with fluency, flexinility and originality in both verbal and non-verbal creativity observable amongst government schools of both urban and rural areas. Similar order of relationship could be seen for non-verbal creativity components in aided schools of rural and urban areas. Creativity did also follow the suit in rural area.

Thus we may conclude that both aided and government schools of urban areas seem to provide an atmosphere

congenial for the growth of creativity alongwith intellectual development, while rural schools seem to lag behind in this respect. However, rural schools have more to contribute towards originality.

- while compating the growth of non-verbal creativity and verbal creativity vis-a-vis intellectual development one may observe that aided schools are more helpful for non-verbal creativity compared with government ones. With respect to location (rural/urban) as far as verbal creativity is concerned, it gets better nurtured in rurban aided and rural government schools as against rural aided and urban government schools respectively.

- it seems appropriate to say that aided schools lay more stress in development of abstract thinking leading to development of non-verbal creativity relatively at a faster rate than government schools irrespective of their locations. Verbal creativity gets due attention in urban aided schools may be due to the availability of better environmental conditions than the government schools. Rural government schools appear to be favourable for growth of verbal creativity as against their aided school

counterparts. This may be due to the academic leadership exceeding in government schools.

Thus on the basis above findings the hypothesis which states that:

"There is no-Significant Relationship Between Creativity and Intellectual Development of Students of Government And Aided Schools in Urban And Rural Areas";

is not accepted.

Creativity And Intellectual Development Location-Wise, Sex- Wise And School-Wise

Table XXII shows that coefficients of correlation between components of creativity and intellectual development of boys and girls studying in government and aided schools of urban and rural areas. The range of coefficients of correlations for various groups were found as follows:

TABLE XXII

COEFFICENTS OF CORRELATIONS BETWEEN COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF STUDENTS : LOCATION WISE, SEX WISE AND SCHOOL WISE.

COMPONENTS OF CREATIVITY	URBAN				RURAL			
	BOYS		GIRLS		BOYS		GIRLS	
	GOVT.	AIDED	GOVT.	AIDED	GOVT.	AIDED	GOVT.	AIDED
NV Fl.	.100*	.557**	.556**	.356**	.092	.352*	.059	
NV Fx.	.226**	.583**	.526**	.424**	.254**	.497**	.354	
NV Or.	.508**	.757**	.742**	.597**	.605**	.757**	-.389	
NV Tot.	.331**	.705**	.682**	.519**	.311**	.569**	.256	
V. Fl.	.305**	.740**	.645**	.478**	.336**	(-) .052	.372	
V. Fx.	.390**	.694**	.632**	.355**	.474**	.467*	.690*	
V. Or.	.662**	.838**	.752**	.710**	.688**	.637**	.893**	
V. Tot.	.521**	.806**	.740**	.617**	.565	.372*	.700*	
Fl.	.275**	.737**	.673**	.498**	.279**	.135	.266	
Fx.	.404**	.717**	.665**	.498**	.424**	.541**	.612	
Or.	.706	.867**	.818**	.461**	.744**	.714**	.811**	
Total Creativity	.531**	.819**	.773**	.736**	.529**	.497**	.579	

* - .05, ** - .01 Level of Significance.

Range of Coefficients of Correlation

	Urban		Rural	
	Type of schools			
Sex	Government	Aided	Government	Aided
Boys	0.100 to 0.706	0.557 to 0.867	0.092 to 0.744	0.052 to 0.757
Girls	0.526 to 0.818	0.355 to 0.736	0.059 to 0.757	to --

Since there were no aided girls schools in rural areas available, therefore, the correlation coefficients for this group could not be shown in the above Table. The table XXII indicates that all coefficients of correlation for urban sample represented significant relationships. In case of boys of government and aided schools of rural area most of the coefficients of correlation indicated significant positive relationship of intellectual developmentwith component of creativity. In case of girls of government schools of rural area, the relationship between intellectual development and components of verbal creativity excepting fluency were found to be significant. It may also be observed that the intellectual development and originality were very associated significantly. However, all other coefficients of correlation for creativity for rural girls of government

schools were found not significant even at .05 level of significances. A comparative view of the Table XXII would reveal the following:

(i) Intellectual development of boys studying in aided schools of urban area was found to have strong linkage with various components of creativity excepting non-verbal fluency as against their government school counterparts.

(ii) In urban area, intellectual development of girls studying in government schools exceeded their aided school counterparts in its relationship with various components of creativity.

In rural area divergent trends could be seen:

(i) Intellectual development of boys studying in aided schools found to be slightly more positively related with non-verbal creativity as against the boys of government schools.

(ii) Intellectual development of boys of government schools were found to be more associated with verbal and total creativity as compared with boys of aided schools. However, the relationship of flexibility with intellectual development of boys of aided schools was higher than that

of boys of government schools.

In case of boys studying in urban and rural areas the following may be inferred:

(i) Boys of aided schools of urban area superceeded their aided rural schools counterparts in relationship between intellectual development and components of creativity.

(ii) Boys of government schools of rural area were found to lag behind to the boys of government schools of urban area in positive association of intellectual development with total non-verbal and total creativity. However, reverse in trend may be observed in relationship of verbal creativity with intellectual development of boys of urban area was observed to be higher than that of rural ones in government schools.

(iii) The relationship of intellectual development of girls of government schools of urban area with non-verbal, verbal and creativity was slightly higher than that of girls of government schools of rural area. However, the relationship of flexibility, Verbal and originality with intellectual development were found to be higher as compared to girls of urban area in

government institutions. All other component of non-verbal, verbal and total creativity were observed to be more in relation with intellectual development of girls of government schools in urban area than their rural counterparts.

On the basis of above mentioned observations the following conclusions may be drawn :

- in urban area, aided schools of boys appear to provide slightly more facilities to their students for development of creativity vis-a-vis their intellectual growth than government schools. However the impact seems to be reverse in case of girls.
- it appears that the environment of aided rural schools was favourable for non-verbal creativity to grow with intellectual development while the government schools seem to contribute relatively more towards the development of verbal creativity alongwith intellectual development of boys.

- boys and girls of urban area belonging to government, and aided schools were at

advantage with regards to both creativity and intellectual development than their rural counterparts.

Thus on the basis of above findings the hypothesis which states that:

> "There is No Significant Relationship Between Creativity And Intellectual Development of Boys And Girls Studying in Government And Aided Schools in Urban And Rural Areas;"

is partially accepted in favour of girls studying in government schools in rural areas.

Creativity and Intellectual Development
Of General and SC/ST Students

In order to study the extent of relationship between components of creativity and intellectual development of genral and SC/ST students, coefficients of correlation were computed and have been presented in table XXIII , obtained coefficeints of correlation ranged from 0.131 to 0.850 for urban rural and total sample. Mostly coefficients of correlation between components of creativity and intellectual development of

TABLE : XXIII

COEFICIENTS OF CORRELATION BETWEEN COMPONENTS OF CREATIVITY AND INTELLECTUAL DEVELOPMENT OF GENERAL AND SC/ST STUDENTS

	URBAN		RURAL		TOTAL SAMPLE	
	GENERAL r	SC/ST r	GENERAL r	SC/ST r	GENERAL r	SC/ST r
NV.FI	.391**	.237*	.131	.302	.319**	.336**
NV.FX	.441**	.336**	.287**	.346*	.392**	.414**
NV.OR	.659**	.428**	.569**	.611**	.604**	.475**
TOTAL NV	.574**	.36[illegible]**	.331**	.489*	.504**	.450**
VI	.548**	.302**	.292**	.201	.462**	.293**
VFX	.553**	.327**	.384**	.411*	.495**	.381**
V.OR	.732**	.685**	.670**	.790**	.6[illegible]2**	.685**
TOTAL V	.678**	.494**	.508**	.560**	.595**	.517**
FL	.556**	.312**	.25[illegible]**	.326	.466**	.363**
FX	.591**	.380**	.384**	.471*	.522**	.453**
OR	.782**	.700**	.708**	.850**	.701**	.712**
TOTAL CREATIVITY	.711**	.494**	.493**	.607**	.619**	.555**

LEVELS SIGNIFICANCE : * = .05; ** = .01 ;

students were found to be significant at 0.01 level and 0.05 level of significance. Relationship between non-verbal fluency and intellectual development of SC/ST students was significant at .05 level. In case of rural sample significant positive relationships were obtained for flexibility and originality with intellectual development whereas fluency and intellectual development of SC/ST students were found to have positive relationships which could not be found to be significant.

Following may be inferred from the above mentioned observations:

- verbal creativity was found to be relatively more associated with intellectual development of both general and SC/ST students as compared with non-verbal creativity.
- components of verbal, non-verbal and creativity were found to be related with intellectual development in an increasing order from fluency to originality through flexibility.
- Association of non-verbal, verbal and total creativity with intellectual development was found to be relating greater in case of general students excepting one (verbal creativity v/s intellectual development of SC/ST students of rural area) as compared to their SC/ST

counterparts. Irrespective of their placement in rural or urban school.

Thus it may be concluded that the general category students excelled then SC/ST counterparts both on non-verbal and verbal creativity vis-a-vis their intellectual development in rural as well as urban schools.

Thus on the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between creativity And Intellectual Development of General and SC/ST Students";

is not accepted.

Creativity And Levels of Intellectual Development Of Students of Urban and Rural Areas

In order to sutdy the extent of relationship between levels of intellectual development and components of creativity of urban and rural samples, the coefficients of correlation were computed and have been presented in Table XXIV . Coefficients of correlation for urban and rural samples ranged from 0.156 to 0.571 and -0.539 to 0.510 respectively. In case of urban sample, all the coefficients were very low to moderate positive

TABLE : XXIV

COEFFICIENTS OF CORRELATION BETWEEN COMPONENTS OF CREATIVITY AND LEVEL OF INTELLECTUAL DEVELOPMENT OF STUDENTS OF URBAN AND RURAL AREAS.

COMP. OF CREAT.	URBAN CONC.(r)	URBAN TRANS. (r)	URBAN FORMAL (r)	RURAL CONC. (r)	RURAL TRANS. (r)	RURAL FORMAL (r)
NV Fl	0.215**	0.218**	0.217**	-0.027	0.087	0.539
NV Fx	0.231**	0.199**	0.239**	0.237*	-0.009	-0.345
NV Or	0.172**	0.243**	0.464**	0.156	0.192	0.236
Tot. NV	0.242**	0.266**	0.369**	0.116	0.082	-0.288
V Fl	0.275**	0.227**	0.415**	0.190	0.376**	0.187
V Fx	0.228**	0.156**	0.424**	0.171	0.270*	0.171
V Or	0.397**	0.370**	0.521**	0.510**	0.470**	0.251
Tot. V	0.344**	0.294**	0.506**	0.327**	0.425**	0.216
Fl	0.294**	0.262**	0.398**	0.113	0.297**	-0.112
Fx	0.274**	0.218**	0.430**	0.226	0.170	-0.105
Or	0.409**	0.412**	0.571**	0.490**	0.447**	0.289
Tot. C	0.357**	0.337**	0.514**	0.273*	0.330**	0.002

* = .05 ** = .01 LEVEL OF SIGNIFICANCE.

significant at .01 level and presented relationships. For rural sample significant positive relationship were observed for : (i) concrete operational level of intellectual development with non-verbal flexibility, verbal creativity, total creativity, verbal and total originality, (ii) transitional operational level with fluency, originality and verbal creativity and total creativity and verbal flexibility. (iii) formal operational level of intellectual development with non-verbal fleuncy representing moderate negatige relationship.

It may also be observed from the table XXIV that in urban sample concrete operation level was slightly more associated with (i) fluency (non-verbal, verbal and total) (ii) flexibility (verbal and total). (iii) originality (non-verbal) and (iv) creativity as compared to rural sample. However, originality of verbal creativity and total originality was found to be more favourable to concrete level of intellectual development of rural students as against their urban counterparts.

Transitional operational level of urban sample w was slightly more associated with components of non-verbal creativity than that of the rural sample. Oppositive was the case with verbal creativity components where reral students were in an advantageous position as compared to urban students. The relationship of two

level with total flexibility, total originality and total creativity were more prominent in urban sample. Total fluency was higher in rural sample but the magnitude of its relationship with transitional level was not significent.

All coefficients of correlation, excepting one between formal operational level of intellectual development and components of creativity were found to be slightly higher in case of urban sample than rural sample. Coefficients of correlation between formal operational level and non-verbal fleuncy was found to be negative and significant at 0.05 level of significance. However, the rural sample witnessed positibe and negative relationships between formal operational level and components of creativity which were not be found significant. The negative relationships between formal operational level and components of creativity may be attributed to non availability of healthy environment in rural area. Lack of appurtunities of frequent dialogue and less developed invironment may the cause of rural sample lagging behind their urban counterparts in this respect. In case of rural sample, transitional level of intellectual development was slightly more associated with total verbal creativity than urban sample.

In case of urban sample, correlations between

creativity and levels of intellectual development seem to follow a pattern of being at a low ebb at concrete level, getting shrinked at transitional level and a spurious growth at formal level with regard to non-verbal creativity, verbal creativity and total creativity.

In case of rural sample, relationship between levels of intellectual development with total verbal creativity and total creativity was observed to be at peak at transitional level and relatively lower at both concrete and formal levels.

On the basis of above observations it may be concluded that:

- levels of intellectual development and components of creativity were progressing unidirectionally case of urban sample.
- the association of intellectual development with creativity greater for urban students as compared to their rural counterparts.
- in rural sample, formal operational level was found independent of total creativity and universely related with non-verbal creativity, verbal creativity appeared to show slightly positive association with formal operational level of thinking.

- the maximum association of creativity was with formal operational level of urban students and transitional level of rural ones.

On the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Creativity And Levels of Intellectual Development of Students of Urban And Rural Areas;"

is partially accepted in favour of rural students.

Creativity And Levels of Intellectual Development Of Boys and Girls

The coefficients of correlation between components of creativity and levels of intellectual development of boys and girls ranged between 0.074 to 0.648. Table XXV shows that most of the coefficients of correlation were significant at .01 and .05 levels of significance. At transitional stage significant relationship existed between intellectual development of boys with non-verbal and verbal flexibility, and at concerete level amongst girls with non-verbal originality, verbal flexibility and total flexibility.

TABLE : XXV

COEFFICIENTS OF CORRELATION BETWEEN COMPONENTS OF CREATIVITY AND LEVELS OF INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS.

	CONC.		TRANS.		FORMAL	
COMP.OF CREAT.	BOYS (r)	GIRLS (r)	BOYS (r)	GIRLS (r)	BOYS (r)	GIRLS (r)
NV Fl	.150*	.244*	.128*	.276**	.240**	.208*
NV Fx	.263**	.229*	.081	.294**	.271**	.226*
Tot. Or	.206**	.137	.219**	.269**	.524**	.366**
Tot. NV	.232**	.247*	.169**	.330**	.407**	.319**
V Fl	.260**	.231*	.163**	.248**	.521**	.252**
V Fx	.305**	.074	.087	.256**	.494**	.318**
V Or	.434**	.408**	.318**	.366**	.613**	.382**
Tot. V	.373**	.288**	.222**	.341**	.599**	.361**
Fl	.254**	.277**	.180**	.296**	.484**	.276**
Fx	.327**	.171	.105*	.327**	.474**	.360**
Or	.445**	.399**	.358**	.404**	.648**	.431**
Tot. Creat.	.369**	.312**	.239**	.390**	.585**	.402**

* = .05 ** = .01 LEVEL OF SIGNIFICANCE

Concrete and formal operational levels of thinking were found to be slightly more related with non-verbal, verbal and total creativity of boys than their girl counterparts, while the girls at transitional level exceeded boys in these aspects of creativity.

Intellectual development of girls at concrete operational level was found to be slightly more associated with non-verbal fluency and total flexibility as compared to boys, for remaining components of creativity the order of relationship got reversed.

Transitional operational level of intellectual development of girls was found to relatively more associated with components of non-verbal, verbal and total creativity than that boys counterparts.

Formal level of intellectual development and components of creativity show higher association in case of boys than girls.

The Table XXV further reveals that the formal operational level of intellectual development of both sexes (excepting formal operational level of intellectual development w/s non-verbal creativity of girls) was slightly highly related with non-verbal, verbal and total creativity as compared to concrete and transitional operational levels.

In case of girls (excepting non-verbal) the extent of relationship between levels of intellectual

development and non-verbal, verbal and total creativity was in correspondence with increasing levels of intellectual development (maximum in case of formal level and miminum for concrete level). However, in case of boys the concrete operational level of intellectual development superceeded the transitional level in relation ship with non-verbal, verbal and total creativity.

On the basis of above observation, it may be concluded that:

- levels of intellectual development of both sexes were found related with non-verbal verbal and total creativity.
- formal operational level of intellectual development was found more associated with the verbal and total creativity in both sexes and non-verbal in boys.
- boys at concrete and formal level of intellectual development were found to be more creative than girls.
- transitional level girls were found to be more creative as compared to boys.

Thus in the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Creativity And Intellectual Development of Boys And Girls;"

is rejected.

Creativity And Levels of Intellectual Development Of Students of Gevernment And Aided Schools.

In order to study the extent of relationship between levels of intellectual development and compents of creativity of students studying in government and aided school, the coeffecients of correlation were computed and have been presented in Table XXVI. Coefficients of correlation ranged from .087 to 0.657. All these coefficients represented very low to high positive relationships. For students of government schools, all coefficients of correlation between level of intellectual development and components of creativity excepting one with non-verbal flexibility, were observed to be significant. In case of aided schools intellectual development demonstrated significant positive relationship with components of creativity excepting for: (a) concrete operation level

TABLE XXVI

COEFFICIENTS OF CORRELATION BETWEEN COMPONENTS OF CREATIVITY AND LEVEL OF INTELLECTUAL DEVELOPMENT OF STUDENTS OF GOVERNMENT AND AIDED SCHOOLS.

COMPONENTS OF CREATIVITY	CONCRETE GOVT. r	CONCRETE AIDED r	TRANSITIONAL GOVT. r	TRANSITIONAL AIDED r	FORMAL GOVT. r	FORMAL AIDED rx
NV Fl.	.184**	.184**	.181*	.207**	.165*	.231**
NV Fx.	.303**	.173**	.154**	.179**	.127	.361**
NV Or.	.179**	.212*	.240**	.225**	.345**	.563**
NV Tot.	.259**	.213*	.233**	.234**	.240**	.478**
V. Fl.	.319**	.150	.222**	.251**	.392**	.396**
V. Fx.	.328**	.087	.198**	.164**	.357**	.513**
V.Or.	.478**	.338**	.410*	.247**	.450**	.597**
V.Tot.	.433**	.214*	.321**	.244**	.452**	.554**
Fl.	.316**	.194*	.249**	.268**	.360**	.391**
Fx.	.367**	.146**	.221**	.166**	.332**	.516**
Or.	.178	.358	.447	.287	.479	.657
Total Creativity	.421*	.251**	.343**	.279	.433**	.580**

of intellectual development with fluency, flexibility and verbal creativity. (b) transitional operation level with verbal flexibility.

The following may be infered from the obtained results:

(i) Association of verbal creativity and non-verbal creativity and total creativity with concrete operation level of intellectual development was relatively greater in government schools than the aided ones.

(ii) Transitional operational level of intellectual development of students of government schools was found to be more related with verbal and total creativity as compared to students of aided schools. However, the association of non.v rbal creatitity was observed to be greater for students for aided schools.

(iii) Formal operational level thinkers of aided schools were found to be slightly more in relation with both non-verbal and verbal creativity than their government school counterparts.

In case of students of aided schools the order of relationship between levels of intellectual development and components of creativity and total creativity was

found to be in increasing order i.e. maximum for formal operational level and minimum for concrete operational level.

In case of students of government schools, no clear trend could be observed for all components of creativity at different levels of intellectual development

The following patterns may however, be derived various components of creativity at different levels of intellectual development.

(i) Transitional operational level was found to be less associated with components of verbal and total creativity as compared to comcrete and formal operational levels of intellectual development.

(ii) The association of total originality, total fluency and creativity with formal operational level were found to be greater than that of other two levels of intellectual development.

(iii) Flexibility (verbal and total). originality (verbal) were found slightly more in relation with concrete operational level of intellectual development as compared to transitional and formal operational levels of intellectual development.

(iv) Non-verbal originality was slightly more associated with formal operational level as compared to concrete and transitional levels of intellectual development.

It may be cconcluded from the above observations that:

-government schools appeared to be relatively more helpful than aided schools, in developing verbal and non-verbal and total creativity at concrete operational level of intellectual development.

- environment of aided schools appeared to be more suiting to transitional level students with regard to their growth of non-verbal creativity while government schools proved to be favourable for growth of verbal creativity.

- learning facilities of aided schools were more favourable to formal operational level students with regard to the development of non-verbal, verbal and total creativity as against government schools.

Thus on the basis of above findings the hypothesis

stat

which states that:

> "There is No Significant Relationship Between Creativity And Levels of *Intellectual Development* of Students of Government And Aided Schools;"

is tenable.

Creativity with Level of Intellectual Development Of General And SC/ST Students

Coefficients of correlation between components of creativity and level of intellectual development viz. concrete, transitional and formal operational level, for both general and SC/ST students are presented in Table XXVII. All coefficients of correlation for general students were indicated positive relationships significant at .01 level of significance. In case of SC/ST students only two coefficients of correlation, for verbal originality versus concrete level and total fluency versus formal operational level, were found to be significant at .05 level, other coefficients of correlation were not significant represents the above observations give rise to the following references:

TABLE XXVII

COEFFICIENTS OF CORRELATION BETWEEN COMPONENTS OF CREATIVITY AND LEVELS OF INTELLECTUAL DEVELOPMENT OF GENERAL AND SC SR STUDENTS.

COMPONENTS OF CREATIVITY	CONCRETE GEN	CONCRETE SC ST	TRANSITIONAL GEN.	TRANSITIONAL SC ST	FORMAL GEN.	FORMAL SC ST
	r	r	r	r	r	r
NV Fl.	.224**	.125(-)	.229**	.076(+)	.227**	.057(-)
NV Fx.	.302**	.105(-)	.194**	.113(-)	.252**	.447
NV Or.	.222**	.070(-)	.241**	.124	.474**	.534
NV Tot.	.288**	.125(-)	.266**	.053(-)	.375**	.543
V Fl.	.275**	.133	.260**	.021(-)	.429**	.126
V. Fx.	.248**	.177	.198**	.202(-)	.433**	.572
V. Or.	.439**	.395*	.377**	.196	.534**	.378
V. Tot.	.372**	.245	.322**	.021(-)	.518**	.378
Fl.	.304**	.015	.290**	.055(-)	.411**	.095
Fx.	.321**	.065	.242**	.191(-)	.431**	.656*
Or.	.454**	.299	.412**	.214	.582**	.546
Total Creativity	.399**	.098	.353**	.044(-)	.521**	.481

In case of genral students, verbal creativity was found to be more associated with levels of intellectual development (concrete, transitional formal) as compared to non-verbal creativity. For SC/ST students non-verbal creativity exceeded verbal creativity with transitional and formal operational level of thinking. Reverse in trend was found with concrete ope rational level where verbal creativity exceeded non-verbal creativity. However, transitional operational level was found to be independent of both non-verbal and verbal creativity. Following conclusions could be drawn:

-non-verbal and verbal creativity were found tobe slightly more associated with different levels of intellectual development of general students as against their SC/ST counterparts excepting for relationship between non-verbal creativity and formal operational level of intellectual development.

- non-verbal creativity and intellectual development relationship was found to be in an increasing order of, transitional to formal through concrete level. for général students. Similar trend may also be observed for verbal creativity. However, in case of ST/SC students creativity had a varying

association with levels of intellectual development. The affected levels were formal and concrete where non-verbal and verbal creativity were respectively predominant.

To sum up, we may say that the association of verbal and non-verbal creativity with levels of intellectual development was greater in general students than their SC/SC counterparts excepting for non-verbal creativity at formal operational level of thinking. It was also noteced that the extent of relationship was maximum at formal level and minimum at transitional level of intellectual development.

Thus on the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Creativity And Intellectual Development of General And SC/ST Students;"

is partialy accepted in favour of SC/ST students.

R E L A T I O N S H I P
O F
INTELLECTUAL DEVELOPMENT WITH ACHIEVEMENT IN MATHMATICS, SCIENCE AND AGGREGATE

One of the domain in which Piaget's work is likely to have its great impact on is the domain of science and mathmetics teaching.

The investigator was also instrusted in studying the extent of relationships between intellectual development and achievement in science(Physical and biological), mathematics and aggregate of all school subjects. So the investigator attempted to study the relationships of aggregate achievement and achievement in science and mathematics with the intellectual development and also at different stages of intellectual development viz. concrete, transitional and formal operation levels . These relationships were studied for boys and girls of rural and urban samples, for students in government and aided schools and lastly for general and SC/ST students. The obtained coefficients of correlation are presented in Table XXVIII to XXXVII . The marks secured by students at their class X board examination were taken as the index of their achievement. Interpretation of the coefficients of correlation between intellectual development and achievement in mathmatics, science and aggregate are

TABLE XXVIII

COEFFICENTS OF CORRELATION BETWEEN ACHIEVEMENT IN MATHEMATICS, SCIENCE AGGREGATE ACHIEVEMENT AND INTELLECTUAL DEVELOPMENT OF STUDENTS.

	URBAN SCHOOL			RURAL SCHOOL			TOTAL SAMPLE		
	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL
MATHS	0.696**	0.730**	0.695**	0.710**	0.637*	0.698**	0.707**	0.729**	0.705**
SCIENCE	0.780**	0.665**	0.734**	0.668**	0.330	0.659**	0.773**	0.668**	0.735**
AGGREGATE	0.822**	0.706**	0.764**	0.714**	0.793**	0.717**	0.811**	0.710**	0.767**

* = .05 ; ** = .01 ; LEVEL OF SIGNIFICANCE.

presented in the following sections of this chapter under various headings

Achievement And Intellectual Development of Students

Table XXVIII shows the scores of intellectual development with achievement in mathematics, science and aggregate achievement in school subjects for boys and girls and for urban and rural students and for the total sample . The coefficients of correlation between intellectual development and scores in mathematics, science and aggregate achievement scores were found to vary from 0.637 to 0.707, 0.330 to 0.780, and 0.706 to 0.822 respectively. At a cursory glance we find that all the correlations excepting one for rural girls (achievement in science v/s intellectual development: r=0.330) represented positive and significant relationships. Coefficient of correlation for rural girls with regard to aggregate achievement and intellectual development was significant at 0.05 level. All other coefficients were significant at 0.01 level of significance.

The extent of relationship with achievement in mathematics and in aggregate were found approximately same in magnitude for urban rural and total sample. In case of rural sample, the extent of relationship of science with intellectual development was found little

less in magnitude than that of their urban counterparts (0.659 against 0.734) It may be accounted for by the lack of adequate environment for learning of science available in rural areas. In fact, the achievement in science is attributable to number of factors including cengenial physical facilities and mental health of the children beside intellectual abilities.

With regard to sex, magnitude of relationship of intellectual development with achievement in science and aggregate achievement observed to be in favour of boys than that of girls. In case of rural sample no clear trend could be traced, may be due to sampling flactuations.

On the basis of above trend, the following conclusions seem to be appropriate:

-higher the intellectual development of the students, higher would be achievement in school subjects.

- location does not effect the students' achievement in mathematics, science and aggregate achievement vis-a-vis intellectual development .

- degree of abstractness at high school science increases with the study of mathematics to science,

- boys were found gainer with regard to achievement in science and aggregate as compared with their girls counterparts at the same level of intellectual development
- the girls were at advantageous position than boys in mathematics achievement vis-a-vis intellectual development.

Thus on the basis of these findings the Null hypothesis which states that:

"There is No Significant Relationship Between Achievement in Mathematics, Science And Aggregate Achievement; With Intellectual Development of Students";

is rejected.

Lawson (1975) also reported the positive correlations (.01 level) between the achievement in science subjects and Piagetian scores. The present study also shows a high significant relationships between intellectual development and academic achievement in science, mathematics and aggregate achievement. This finding give strength to other findings where intellectual development and achievement in science were found to have positive and significant relationship (Chiappetta, 1974; Sayre and Ball, 1975; Lawson, 1975; Lawson and Blake, 1975; Kolodiy, 1977; Wheeler, 1977;

Upadhaya, 1978 and Kumar, 1982) but contrary to the findings of Subhadhia, 1977 and Das Gupta, 1977 who could not find any significant relationship between the two variables.

Achievement And Intellectual Development of Students of Gevernment And Aided School

Table XXIX shows coefficients of correlation between achievement in mathematics, science and aggragate achievement and intellectual developmant of students studying in government and aided schools. In urban and rural and total sample coeficients of correlation were found to be ranging from 0.651 to 0.792, all significant at .01 level of significance.

Table XXIX shows that intellectual development has a significant positive contributing towards the aggregate achievement. It was relatively higher in government schools than the aided ones. While comparing government and aided schools of urban and rural and total sample, one would find that for urban and total sample the influence of intellectual development was more towards science achievement in aided schools than the government schools. On the contrary intellectual development had greater impact on achievement in mathematics in government schools as against aided schools.

TABLE : XXIX

COEFFIECIANTS OF CORRELATION BETWEEN ACHIEVEMENT IN MATHEMATICS, SCIENCE AND AGGREGATE ACHIEVEMENT AND INTELLECTUAL DEVELOPMENT OF STUDENTS OF GOVERNMENT AND AIDED SCHOOLS

	URBAN		RURAL		TOTAL SAMPLE	
	GOVER. MENT	AIDED	GOVER. MENT	AIDED	GOVER. MENT	AIDED
MATHS	0.702**	0.695**	0.687**	0.769**	0.710**	0.700**
SCIENCE	0.734**	0.745**	0.657**	0.651**	0.732**	0.744**
AGGRE-GATE	0.792**	0.735**	0.729**	0.655**	0.792**	0.734**

*= .05; ** = .01; LEVEL OF SIGNIFICANCE.

In rural setting the achievement in science was more positively a fected with intellectual development in government schools, while in aided schools intellectual development appeared to be related with achievement on mathematics to a greater degree.

Students of government schools of urban area exceeded their governament sehools in achievement in mathematics, science and in aggregate vis-a-vis intellectual development.

Urban aided schools appeared to be relatively more favourable for achievement science and aggregate vis-a-vis intellectual development than rural aided schools However, achievement in mathematics was associated with intellectual development in rural aided schools than urban aided schools.

The above mentioned results appear to be because of the following : (i) government schools are better equipped with well qualified staff as compared to aided schools (ii) optimum utilization of facilities and resources is done in aided schools and government schools take things easy.

On the basis of above observation the following may be concluded:

-intellectual development is an important important determint of achievement.

- government schools seems to provide better ground for learning of mathematics, while aided ones for science in urban areas.
- in rural settings mathematics achievement was relatively more influenced by intellectual development.
- government schools have over all supermacy over aided schools so far as intellectual development and aggregate achievement relationship is concerned.

At a glance on the basis of above findings it may be said that for total envionment of government schools was better for achievement in mathematics and aggregate achievement, while environment of aided school was better for achievement in science against governmennt schools.

Thus on the basis of the null hypothesis which state that:

"There is No Significant Relationship Between Achievement in Mathematics, Science and Aggregate Achievement And Intellectual Development of Students;"

Achievement And Intellectual Development
Sex Wise, School Wise And Location Wise

Table XXX forvides a comprehensive view of relationships of intellectual development with achievement in mathematics and science and aggregate achievement for boys and girls studying in government and aided schools of urban and rural areas. The correlations have been formal to range from 0.330 to 0.838, these represent low to very high positive relationships, significent at .01 level of segnificance in most of the cases. The only exception is the girls of government schools of rural area, where a low positive relationship has been observed. Paired comparisions would revals the following: (i) Achievement in mathematics of boys in urban government schools was more associated with levels of intellectual development as compared to their counterparts in aided schools. (ii) Achievement in mathematics and aggregate achievement was found to be related relatively more by intellectual development of urban girls and rural boys than their counterparts in respective settings. (iii) Urban boys are achievement in science and aggregate achievement with regard to their intellectual development in government schools. Achievement in mathematics of boys in government school of urban area and rural boys in aided schools were found to be relatively more positively

TABLE : XXX

COEFFICIENTS OF CORRELATION BETWEEN INTELLECTUAL DEVELOPMENT AND ACHIEVEMENT IN MATHEMATICS SCIENCE AND AGGREGATE ACHIEVEMENT AND INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS IN GOVERNMENT AND AIDED SCHOOLS OF URBAN AND RURAL SETTINGS.

	URBAN				RURAL			
	GOVERNMENT		AIDED		GOVERNMENT		AIDED	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
MATHS	0.728**	0.703**	0.683**	0.785**	0.702**	0.632*	0.769**	NIL
SCIENCE	0.788**	0.671**	0.794**	0.651**	0.671**	0.330	0.651**	NIL
AGGREGATE	0.838**	0.749**	0.833**	0.646**	0.730**	0.793**	0.655**	NIL

* = .05 ; ** = .01 ; LEVEL OF SIGNIFICANCE.

related with their intellectual development as compared with rural and urban counterparts respectively. (iv) Urban girls of government schools were found to be in advantageous position as compared with rural girls of government schools with regards to achievement in mathematics and science viz-a-vis their intellectual development.

Form the above observations it may be concluded that :

- achievement of students were related with their intellectual development in both type of schools in urban and rural areas. However achievement in science of rural girls of government schools was related not significantly with their intellectual development.

Thus on the basis of above finding the hypothesis which states that :

"There is No Significant Relationship Between Achievement (in Science, Mathematics and Aggregate) And Intellectual Development of Boys And Girls in Government And Aided Schools Of Urban And Rural Areas ;"

is partialy accepted in favour of girls of rural areas in government schools.

TABLE : XXXI

COEFFICIENTS OF CORRELATION BETWEEN ACHIEVEMENT IN MATHEMATICS, SCIENCE AND AGGREGATE ACHIEVEMENT AND INTELLECTUAL DEVELOPMENT OF GENERAL AND SC/ST STUDENTS.

	URBAN		RURAL		TOTAL SAMPLE	
	GENERAL	SC/ST	GENERAL	SC/ST	GENERAL	SC/ST
MATHES	0.696**	0.663**	0.717**	0.579**	0.668**	0.572**
SCIENCE	0.729**	0.790**	0.682**	0.519**	0.690**	0.606**
AGGRE GATE	0.765**	0.724**	0.728**	0.641**	0.732**	0.595**

* = .05 ; ** = .01 ; LEVEL OF SIGNIFICANCE

Achievement and Intellectual Development of Feneral and SC/ST Students

An inspection of the table XXXI reveals that the coefficients of correlation between intellectual development of both gategories of students namely general and SC/ST and achievement in mathematics, science and aggregate achievement were found to represent positive and significant (at .01 level) relationships varying from high to very high in magnitudes.

It can also be observed from the table XXXI that the relationship of intellectual development and achievement in mathematics, science and aggregate was of higher degree in case of general candidates as compared to their SC/ST counterparts, excepting for urban SC/ST students where this association in case of science achievement and intellectual development exceeded in favour of SC/ST students.

From the above observation it may be concluded that

- the intellectual development has positive and significant contribution towards achievement in science, mathematics and in aggregate irrespective of the category(General, SC/ST) and the location of the sample.

- general category candidates appear to be advantageous position as against SC/ST candidates with regard to achievement vis-a-vis intellectual development.
- SC/ST candidates of urban area seems to utilize their intellectual abilities more for achieving higher in science.

Thus on the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Achievement(in Mathematics, Science and Aggregate) And Intellectual Development of General And SC/ST Students";

is rejected.

Achievement in Mathematics And Levels of Intellectual Development of Boys and Girls Location Wise

Table XXXII reveals relationship between achievement in mathematics and levels of intellectual development viz. concrete, transitional and formal operational levels of studdnts of urban, rural and total sample.

The coeffieients of correlation ranged from 0.111 to 0.804, which represented very low to very high correlation for various groups. All correlations were

TABLE : XXXII

COEFFICIENTS OF CORRELATION BETWEEN ACHIEVEMENT IN MATHEMATICS AND LEVELS OF INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS

	URBAN SAMPLE 6			RURAL SAMPLE			TOTAL SAMPLE		
	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL
CONCRETE	0.233**	0.190*	0.188**	0.402**	0.804*	0.381**	0.273**	0.170**	0.226**
TRANSITIONAL	0.388**	0.466**	0.374**	0.501**		0.507**	0.368**	0.469**	0.381**
FORMAL	0.461**	0.111	0.352**	0.674**		0.674**	0.477**	0.111	0.365**

* = .05 ; ** = .01 ; LEVEL OF SIGNIFICANCE .

found significant at .01 level excepting one for girls of urban area at formal stage. Transitional operational level of intellectual development was found to contribute relatively more towards achievement in mathematics than other stages of intellectual development, namely formal and concrete operational levels, in case of urban and total sample. However, in rural area achievement in mathematics was found to be related with the levels of intellectual development in increasing order from concrete to transitional to formal level.

Formal level of intellectual development was found to have relatively higher impact on the mathematics achievement of boys than of girls of urban area and the total sample .

Transitional operational level contributes more towards mathematics achievement in case of girls irrespective of their being rural/urban. In case of girls of rural area very close association was observable between concrete level of intellectual development and achievement in mathematics.

On the basis of above observations following findings emerge:

-achievement in mathematics girls inhanced with the increased levels of intellectual development of the students.

- achievement of boys in mathematics gets relatively more influence with the intellectual development than girls in general , especially in urban settings.
- girls achievement in mathematics is favoured much by transitions level of their intellectual development.

Thus the hypotheses which states that:

"There is No Significant Relationship Between Achievement in Mathematics And Levels of Intellectual Development of Science Students;"

is rejected.

Mathematics And Levels of Intellectual Development Of Students in Government And Aided Schools

Coeficients of correlation between achievement in mathematics and levels of intellectuals development of students studying in government and aided schools located in urban, rural and total sample have been presented in thable XXXIII .

For total sample the table XXXIII shows that all coefficients of correlation for various levels of intellectual development of students in government

TABLE : XXXIII

COEFFICIENTS OF CORRELATION BETWEEN ACHIEVEMENT IN MATHAMETICS AND INTELLECTUAL DEVELOPMENT OF GOVERNMENT AND AIDED SCHOOLS

	URBAN		RURAL		TOTAL SAMPLE	
	GOVERNMENT	AIDED	GOVERNMENT	AIDED	GOVERNMENT	AIDED
CONCRETE	0.138	0.312*	0.281*	0.814*	0.171*	0.331*
TRANSITIONAL	0.397**	0.332**	0.516**	0.433	0.411**	0.318**
FORMAL	0.211*	0.473**	0.719*		0.221*	0.493**

* = .05 ; ** = .01 ; LEVEL OF SIGNIFICENCE.

and aided schools with achievement in mathematics were found to be varying from very low to moderate (0.171 to 0.493) and these indicated significant positive relationship. The extent of relationship for achievemennt in mathematics with concrete and formal levels of intellectual development, for students of aided schools have been found slightly higher than that of students of government schools. However, inverse in trend may be seen with regards to transitional level of intellectual development verses achievement in mathematics. Similar trend may be onserved in urban school with regards to relationship between achievement in mathematics and levels of intellectual development of the students.

In rural aided schools intellectual developmento of students was found to higher related with achievement in mathematics at concrete level, while at transitional stage it was in tune with urban and total sample where students of government schools appeared to related relatively more with level of intellectual development than that of students of aided schools.

So on the basis of the above observations following conclusions may be drawn:

-levels of intellectual development of students was an important aspect for their achievement in mathematics irrespective of their being

in government or aided schools.

- environment of government schools seems to render more hilp to transitional level students for their higher achievement in mathematics against aided school students.

- environment of aided schools was found more favoruable for students at concrete and formal operational levels of intellectual development for their achievement in mathematics than that of government school students.

Thus on the basis of above findings the hypothesis which states that :

"There is No Significant Relationship Between Achievement in Mathematics And Intellectual Development of Students in Government And Aided Schools of Urban and Rural Areas."

is tenable.

Achievement In Science And Levels of Intellectual Development of Boys and Girls

Coefficients of correlation between achievement in science and levels of intellectual development of students, presented in table XXXIV show very low to moderate (0.150 to 0.459), positive and significant relationship

Table XXXIV further indicates that in urban and total sample, levels of intellectual development of boys were significantly related with achievement in science. However, in rural areas only the transitional operational level of intellectual development was found to be significantly related with achievement in science.

The extent of relationship was found in increasing order from concrete to formal through transitional level of intellectual development for urban and for the total sample. However, in case of boys of rural areas transitional level of intellectual development was found to have a dominant role in the achievement in science.

In total and urban sample transitional and formal levels of intellectual development of girls were found to be significantly (at .01 level of significance) related with achievement in science. However, achievement in science appeared to be not related the concrete level of intellectual development of girls .

TABLE : XXXIV

COEFFICIENTS OF CORRELATION BETWEEN ACHIEVEMENT IN SCIENCE AND LEVELS OF INTELLECTUAL

DEVELOPMENT OF BOYS AND GIRLS

	URBAN	URBAN		RURAL			TOTAL		
	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL
CONCRETE	0.312**	- 0.094	0.151*	0.228	- 0.247	0.160	0.294**	- 0.088	0.150**
TRANSITIONAL	0.436**	0.451**	0.415**	0.665**		0.668**	0.449**	0.455**	0.438**
FORMAL	0.544**	0.275**	0.447**	0.354		0.354	0.556**	0.275**	0.459**

* = .05 ; ** = .01 ; LEVELS OF SIGNIFICANCE

Girls at concrete level of rural area showed negative and very low relationship with intellectual development and achievement in science may be because of sampling fluctions (N=8) .

The following main inferences seem approapriate to be drawn on the absis of above observations:

-intellectual development has substantial influence over the achievement of students in general .

-rural boys and urban girls follow a slightly different pattern at transitional operational level than that of boys at concrete and formal levels of intellectual development.

So on the basis of these relults we reject the null hypothesis which states that :

"There is No Significant Relationship Between Achievement in Science and Intellectual Development of Boys and Girls".

Pandey (1979) also reported that achievement in science subjects increases with the advancement of levels of intellectual development. This study gives strength parrally to findings of above study.

Achievement in Science and Levels of Intellectual Development of Students of Government and Aided Schools

Table XXXV shows relationship between achievement in science and levels of intellectual development of students studying in government and aided schools urban and rural area and the total sample.

For total sample, it may be observed that most of the correlations have been founded to be positive and Significant at .01 level of significance. The relationship between achievement in scince and intellectual development at concrete level of students studying in government schools was nearly zero.

It may be noted that the maximum influence of intellectual development on achievement in science in government schools was exerted by transitional level students while aided schools formal level of intellectual development has more contribution towards achievement in science as against in two other stages . It may be due to the shift of emphasis to formal level of thinking in aided schools, where concrete level students were relatively more disadvantaged in government schools as against their counterparts in aided schools. Urban area students were found to show similar trend of relationship between intellectual development and achievement in science.

TABLE : XXXV

COEFFICIENTS OF CORRELATION BETWEEN ACHIEVEMENT IN SCIENCE AND LEVELS OF INTELLECTUAL DEVELOPMENT OF STUDENTS STUDYING IN GOVERNMENT AND AIDED SCHOOLS OF DIFFERENT SETTINGS

	URBAN		RURAL		TOTAL SAMPLE	
	GOVERNMENT	AIDED	GOVERNMENT	AIDED	GOVERNMENT	AIDED
CONCRETE	0.066	0.277**	0.076	0.232	0.066	0.273*
TRANSITIONAL	0.504**	0.260**	0.684**	0.525	0.529**	0.257**
FORMAL	0.391**	0.543**	0.615		0.402**	0.547**

* = .05 ; ** = .01 ; LEVELS OF SIGNIFICANCE

For rural area the correlation veried from 0.076 to 0.684. The only significant correlation was at transitional level of government school students. In rural settings both government and aided schools have been appeared to give due emphasis on transitional level. Governmant schools superceds the aided ones in this respect.

Following conclusions may be drawn.

-in aided schools of urban area and total sample concrete and formal operational levels of intellectual development was higher related with achievement in science than their government schools counterparts.

- transitional operational level was more associated with achievement in science for students of government schools against students of aided schools. It was true for schools irrespective of their locations.

Thus on the basis of above finding the hypothesis which states that.

"There is No Significant Relationship Between Achievement in Science And Levels of Intellectual Development of Students of Government and Aided Schools;"

is partialy accepted.

Aggregate Achievement and Levels of Intellectual Development

The forrelations compouted for the relationship between aggregate achievement scores and defferent levels of intellectual development viz. formal, transitional and concrete operational levels have been presented in table XXXVI.

Table XXXVI shows that aggregate achievement scores and levels of intellectual development of students of urban, rural and total sample were significantly related the relationship was higher in case of transitional level students than their concrete and formal operational levels counterparts in urban and total sample. However in case of rural students at formal level the correlation was found higher than litter concrete or transitional level students.

With regard to sex, the level of intellectual development of both boys and girls were found to contribute significantly towards aggregate achievement in total sample, relatively weaker relationship was observedin case of girls than boys for aggregate achievement with levels of intellectual development

In urban area the aggregate achievement of girls was not related to intellectual development at formal operational level. The relationship of aggregate

TABLE : XXXVI

COEFFICIENTS OF CORRELATION BETWEEN LEVELS OF AGGREGATE ACHIEVEMENT AND LEVEL OF INTELLECTUAL DEVELOPMENT OF BOYS AND GIRLS

	URBAN			RURAL			TOTAL		
	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL
CONCRETE	0.392**	0.241*	0.330**	0.384**	0.281	0.366**	0.393**	0.228*	0.337**
TRANSITIONAL	0.500**	0.510**	0.431**	0.579**		0.566**	0.563**	0.507**	0.453**
FORMAL	0.515**	0.074	0.304**	0.583*		0.583*	0.542**	0.073	0.331**

* = .05 ; ** = .01 ; LEVEL OF SIGNIFICANCE

achievement of girls with intellectual development was higher at transitional level as against concrete level of intellectual development .

In rural area, relationship between aggregate achievement and concrete operational level of girls was not significant.

On the basis of the above observation following main findings may be drawn:

-intellectual development was related relatively more in case of boys than girls.

- higher the intellectual development of the students most likelyhood would be of higher being the aggregate achievement.

Thus on the basis of above findings the hypothisis states that:

"There is No Significant Relationship Between Levels of Intellectual Development of The Students With Their Aggregate Achievement Scores."

is rejected.

Aggregate Achievement And Intellectual Development Of Students of Government and Aided Schools

It is evident from the table XXXVII the coefficients of correlation between aggregate achievement and levels of intellectual development of students studying in gogernment and aided schools of urban and rural areas and of total sample were positive and significant at 0.01 level of significance, which represented low to moderate. However, in rural area transitional and formal levels of intellectual development of students of government schools was found significantly related with their aggregare achievement. In aided schools concrete level of intellectual development of the students was found significantly related with their aggregate achievement. Remaining all other coefficients of correlation between aggregate achievement and intellectual development of students were not significant.

For urban and total sample, it may therefore be infered that concrete and formal operational students studying in aided schools were gainer in aggregate achievement as against students of government schools at their same levels of intellectual development . It seems appropriate to say ,(as has already be mentioned earlier) that environment of aided schools provide

TABLE : XXXVII

SOEFFICIENTS OF CORRELATION BETWEEN AGGREGATE ACHIEVEMENT AND LEVELS OF INTELLECTUAL DEVELOPMENT OF STUDENTS OF GOVERNMENT AND AIDED SCHOOLS

	URBAN		RURAL		TOTAL SAMPLE	
	GOVERN MENT	AIDED	GOVERN MENT	AIDED	GOVERN MENT	AIDED
CONCRETE	0.256**	0.462**	0.232	0.700*	0.254**	0.479**
TRANSIT IONAL	0.569**	0.263**	0.590**	0.439	0.564**	0.247**
FORMAL	0.237**	0.333**	0.625*		0.260**	0.369**

* = .05; ** = .01; LEVEL OF SIGNIFICANCE

slightly better learning environment to students at concrete and formal levels of intellectual development facilitating higher aggregate achievement than that of government school students at the respective leves of intellectual development However, environment for learning in government schools was found favourable for students at transitional level of intellectual development with regard to their aggregate achievement as compared to aided schools.

A close scruitiny of table XXXVII reveals that in rural area environment of aided school was found suiting to the needs of students at concrete level of intellectual development leading to their higher scores in aggregate achievement. Similarly environment of government schools was found in favour of students at transitional and formal levels of intellectual development to secure higher scores in aggregate achievement. However, concrete level studants of aided schools showed relationships with aggregate achievement scores. On the basis of above observation it may be concluded that:

- environment of aided schools is helpful in promoting higher achievement of students at concrete and formal levels of intellectual development as compared with government schools.

- environment of government schools favour students at transitional level of intellectual development to achieve higher scores in aggregate achievement as against aided schools.
- in rural areas government schools provide relatively better means of higher achievement to students at transitional levels of intellectual development, while aided schools appear to suit concrete level students so far as achievement is concerned.

Thus on the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Aggregate Achievement And Lavels of Intellectual Development of Students of Government And Aided Schools."

is rejected.

RELATION SHIP BETWEEN INTELLECTUAL DEVELOPMENT OF THE STUDENTS AND SOCIO-ECONOMIC STATUS OF PARENTS

The extent of relationship between intellectual development of the students with components of socio-economic back ground have been studed and presented as follows:

Intellectual Development of Students and Education of Fathers' and Mothers'

Table XXXVIII reveals the relationship between fathers'/mothers' education and intellectual development of their children.

For the total sample, the oefficients of correlation were found to be ranging from 0.239 to 0.400. All representing low positive correlatinns, but significant at .01 level of significance.

The contribution of fathers' education towards intellectual development of boys, and the contribution of mother's education towards intellectual development of girls, was higher than the sex opposite to them. Besides, the contribution of mothers' education was found to be higher than that of fathers' education for both boys and girls. It may, therefore, be interpreted that mothers' education play key role in the intellectual development of the children and that

TABLE : XXXVIII

COEFFICIENTS OF CORRELATIONS BETWEEN INTELLECTUAL DEVELOPMENT OF STUDENTS AND EDUCATION OF PARENTS

INTELLECTUAL DEVELOPMENT	FATHERS' EDUCATION r	MOTHERS' EDUCATION r
URBAN		
BOYS	0.303**	0.354**
GIRLS	0.240**	0 345**
GOVERNMENT	0.271**	0.315**
AIDED	0.374**	0.403**
TOTAL	0.284**	0.352**
RURAL		
BOYS	0.142	-0.052
GIRLS	-0.147	0.706*
GOVERNMENT	0.038	-0.045
AIDED	0.411*	0.057
TOTAL	0.101	-0.041
TOTAL SAMPLE		
BOYS	0.302xx	0.339**
GIRLS	0.261**	0.377**
GOVERNMENT	0.239**	0.320**
AIDED	0.381**	0.400**
TOTAL	0.294**	0.354**

LEVELS OF SIGNIFICANCE : * = .05 ; ** = .01 ;

the education of father/mother contribute relatively more for the children of their own sex. It may be consi considred saft to say that higher the education of the parents more likelyhood of attaining formal operational level by the children and vice-versa. The chances get further increased with the increase in the education level of mothers.

Table XXXVIII further indicates that the extent of the relationship between father/mothers' education and intellectual development of their children was found to be relatively higher for the children studying in aided schools as compared with their counterparts in government schools. It may be due to the fact that parents higher in educational status perfer to send their children to aided schools rather than government ones. Here it will not be out of context to mention that aided schools seem to contribute more than government schools towards the intellectual development of students i.e. the chances of students reaching the formal stage increases with the entry of a child into aided school as against a government one.

It is also evident from the table that the coefficients of correlation for urban sample range from .240 to .403. All these values were significant at .01 level of significance and represented low position

correlation between the education of father/mothers' and the intellectual development of their children. It indicated the same trend as in case of total sample Main finding were as follows:

- contribution of mothers' education was higher than that of fathers' education towards intellectual development of children and that it had relatively more influence on the children of the same sex as the parents.
- aided institutions contributed more than government institutions towards the intellectual growth of the students. A look at table XXXVIII with regard to rural sample, reveals that the coefficients of correlation range from -0.147 to 0.706 for various groups of students It may be noticed that mothers' education was found to have no correlation with the intellectual development of boys and students neither government or aided schools. However in case of rural girls a high possitive correlation to the tune of 0. 706 was obserable significant at .05 level. It gives rise to the inference that the higher the level of mothers' education in rural area higher would be the chances of girls reaching

at the formal operational level of thinking and vice-cersa. Mothers' education was found to have nothing to do with the education of boys and indicated indifference to type of schools. - fathers' education on the contrary was found to have some impact on the intellectual development of the boys, while there was a negative influence in similar weightages on the education of girls. It may be due to the fact that even the educated fathers' in the rural area donot encourage girls' education to an equal level as that of boys. Significant influence of fathers' education on intellectual development of children was seen in case of aided schools. It appears that perhaps aided schools provide relatively more opportunities for the intellect to bloosom even in rural setting.

Thus on the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Intellectual Development of Students And Education of Parents;"

is rejected.

Intellectual Development Of Student And Occupations Of Fathers'/Mothers'

In table XXXIX presents coefficients of correlation between intellectual development of student and occupation of fathers'/mothers' .

For total sample all coefficients of correlation have been found to indicate relationship significant at .01 level of significance which range 0.223 to 0.354. It gives rise to the inference that the higher the occupation of parents higher would be chances of their wards attaining the formal operation level of intellectual development and vice-versa. It seems that the higher level of occupational status of parents acts as a motivating factor for children to reach higher intellectual development, perhaps greater facilities are being provided by such parents, generating better educational environment. Thus the parent (father and mother together) occupation seems to have positive contribution towards intellectual development of the children.

The contribution of mothers' occupation appears to be higher than that of fathers' towards intellectual development of various groups of students, viz, girls and students of government and aided schools.

TABLE : XXXIX

COEFFICIENTS OF CORRELATION BETWEEN INTELLECTUAL DEVELOPMENT OF THE STUDENTS AND PARENTS' OCCUPATION

INTELLECTUAL DEVELOPMENT	FATHERS' OCCUPATION r	MOTHERS' OCCUPATION r
URBAN		
BOYS	0.289**	0.313**
GIRLS	0.193**	0.303**
GOVERNMENT	0.202**	0.292**
AIDED	0.339**	0.340**
TOTAL	0.257**	0.309**
RURAL		
BOYS	0.240	0.078(-)
GIRLS	0.310*	0.251(-)
GOVERNMENT	0.155*	0.102
AIDED	0.495*	0.000
TOTAL	0.206**	0.099(-)
TOTAL SAMPLE		
BOYS	0.306**	0.292**
GIRLS	0.223**	0.300**
GOVERNMENT	0.241**	0.274**
AIDED	0.354**	0.339**
TOTAL	0.286**	0.298**

LEVELS OF SIGNIFICANCE : * = .05 ; ** = .01 ;

The table XXIX also shows that the children from high occupation group parents derived more advantage if placed in aided schools than in government schools and perhaos low occupation group parents children seem to be slightly lesser when intellectual development is cosidered.

It is also evident from table XXIV that coefficients of correlation for urban sample ranged from 0.193 to 0.340. All these correlations were found significant at .01 level of significance and these represented low positive correlatiojs. Correlation for urban sample indicates the trend similar to the total sample. Thus main finding may be concluded as fallows:

- higher occupation of parents leads to the likelyhood of attaining formal operation level by the children and vice-versa.
- higher occupations of mothers contribute more in intellectual development of the children as compared with fathers' contribution in case of urban children.
- wards of parents with higher occupational status seem to derive more advantage from aided schools when compared to government schools. While opposite is tune in the case of low occupational status parents' wards.

Further examination of the table shows that coefficients of correlation between occupation of fathers'/mothers' and intellectual development of students of rural schools were found to be ranged between 0.045 to 0.411. These represented no relationship for same group and very low to moderate relationship for other groups.

The table further reveals that the correlations between fathers' occupations and intellectual development of the children were found to range between 0.155 and 0.495 representing very low to moderate positive relationship for various groups. The contribution of fathers' occupational status was relatively more in case of girls as against boys and aided school as against government schools. It may, therfore, be interpreted that higher occupational status of the father contributes positively towards intellectual development of children even in rural area. Girls and students of aided schools were the beneficiaries with regards to intellectual development vis-a vis fathers' occupation.

The range of correlations with regard to mothers' occupation in rural area was -0.251 to 0.102 representing low relationship. Independence of mothers occupational status . Intellectual development as in case of boys , students of aided schools and total rural sample.

However, low positive relationship was observable with regards to student of governments institution where increase in mothers' occupational status appears to help increase the intellectual development of the students. Though not significant low negative correlation between mothers' occupational status and intellectual development of girls signifies an inverse relationship between the two. It appears to indicate an anomolous situation, may be due to a very small sample (N = 8).

Thus on the basis of above findings the hypothesis which states that:

> "There is No Significant Relationship Between Intellectual Development of The Students And Occupation of Parents;"

is partialy accepted in favour of rural girls.

Intellectual Development of Students And Their Parents' Income

Table XL shows correlations between parents' income and intellectual development of the science students. For the total sample, correlation were found to be ranging from 0.432 to 0.484, all representing moderate positive correlations significant at .01 level of significent.

TABLE : XL

COEFICIENTS OF CORRELATIONS BETWEEN INTELLECTUAL DEVELOPMENT OF THE STUDENTS AND THE INCOME OF THEIR PARENTS

INTELLECTUAL DEVELOPMENT	N	PARENTS INCOME r
URBAN		
BOYS	530	0.502**
GIRLS	362	0.447**
GOVERNMENT	543	0.440**
AIDED	349	0.541**
TOTAL	892	0.485**
RURAL		
BOYS	126	0.108
GIRLS	008	0.112
GOVERNMENT	111	0.036
AIDED	023	0.484**
TOTAL	134	0.100
TOTAL SAMPLE		
BOYS	656	0.484**
GIRLS	370	0.460**
GOVERNMENT	654	0.432**
AIDED	372	0.544**
TOTAL	1026	0.480**

LEVELS OF SIGNIFICENCE: * = .05 ; ** = .01 ;

The total sample correlations show that parents' imcome were found to be significantly associated with the intellectual development of their wards. The same appears to be true for groups of boys, girls, students in government and aided schools. It may be considered safe to say that higher the income of the parents more likelyhood of children attaining formal operational level. Parents' income seem to influence the intellectual development of students relatively more in case of boys than girls. Also the children of higher income group parents' appear to drive more advantages if placed in aided school than their counterparts in government school and parhaps low income group children seem to be somewhat looser so far as intellectual development in concerned.

It is also eveident from table XL that the coefficients of correlation for urban sample ranged from 0.440 to 0.502. All of these correlations were found significant at .01 level of significance and these represented moderate positive correlations between the education of parents' and intellectual development of the science students. It indicates a trend similar to the total sample. Thus the main finding may be summarized as below:

-contribution of parents' income was higher towards intellectual development of the boys than that of girls(0.502 against 0.447).

- children of parents' having higher incomes group derived more advantages with regards to their intellectual development in aided school while lower income group children seem to be disadvantaged.

A close examination of the table reveals that the coefficients of correlation between parents income and intellectual development of the students, of rural area werefound to range from 0.036 to 0.486. Correlations between parents' income and intellectual development of the students of aided school of rural area was found to be moderate and positive significant at 0.01 level of significance The remaining correlatiions were found to be of very low in case of boys, girls and aided schools. There was no such relationship found in government schools These correlations seem to give rise to a conclusion that is rural area, the intellectual development of children in government schools is independent of the income of their parents. However, in the case of students of aided schools parents' income has been found to be related with the intellectual development of the science students.

The relationship is almost of the same magnitude for boys and girls.

It may therefore be infered that parents income positively contribute towards intellectual development of children to some extent in rural area as well and its influence is uniform for both boys and girls. Besides this aided schools appear to be favourable for the intellectual development of the children belonging to high income group families.

Thus on the basis of above findings the hypothesis which states that:

> "There is No Significant Relationship
> Between Intellectual Development of
> Students And Their Parents' Income;"

is rejected.

Intellectual Development Of The Students And Size Of The Family

In order to ascertain the extent of the relationship between intellectual development of the students and size of the family, correlations have been computed. The obtained correlations are reported in the table XLI .

For the total sample coefficients of correlation

TABLE XLI

CORRELATIONS BETWEEN INTELLECTUAL DEVELOPMENT OF THE STUDENTS AND SIZE OF THE FAMILY

INTELLECTUAL DEVELOPMENT.	N	FAMILY SIZE
URBAN:		
BOYS	530	-0.147**
GIRLS	362	-0.150**
GOVERNMENT	543	-0.148**
AIDED	349	-0.155**
TOTAL	892	-0.147**
RURAL:		
BOYS	126	-0.032
GIRLS	008	-0.492
GOVERNMENT	111	-0.095
AIDED	023	0.187
TOTAL	134	-0.062
TOTAL SAMPLE		
BOYS	656	-0.169**
GIRLS	370	-0.183**
GOVERNMENT	654	-0.193**
AIDED	372	-0.153**
TOTAL	1026	-0.176**

LEVELS OF SIGNIFICANCE: * = .05 ; ** = .01 ;

were found to be ranging from -0.193 to -0.153, all representing low negative correlations significant at .01 level of significant for various group viz, boys girls students of government and aided schools.

On the basis of above correlations it may be said that large size of family hampers the intellectual development of the students. This may be because of the fact that in the larg sized family available facilities are shared by more members as compared to small sized family, inturn lowering the quality of environmental disposal of the students it may be interpreted, that student beloging to a small family were in advantageous position so far as intellectual development in concerned.

Coefficients of correlation between intellectual development of girls with size of family has been found slightly higher than that of boys (-0.183 against -0.169) It may be infered from such correlations that in case of girls the bigger size of the family exerts more detrimental influence on intellectual development as compared to boy. This relationship is not surprising because in a large sized family, girls have to share the domestic work getting lesser time for herself than that of a boy belonging to a similar sized family. So it may be fairly to conclude that in a family of large size, girls are more deprived with regards ot intellectual

development than boys.

Family size seems to influence the intellectual development relatively more in case of students of government school. It may be considered safe to say that the children of large family size derive relatively more advantage in placed in aided school than in the government school.

Coefficients of correlation between the size of family and intellectual development of the students of urban area are presented in the table XLI which shows low negative relationships ranging from -0.147 to -0.155 significant at .01 level of significance.

In case of the urban students and for both sexes trends similar to the total sample have been found. However in the case of type of schools trend was found to be of reverse nature.

Table XLI further reversed the relationship obtained for rural sample which range from -0.492 to 0.187. Intellectual development seems to be almost independent of family size in case of boys, students of government schools and total rural sample. Moderate negative relationship may be observed in case of girls where the increase in family size appears to severely hamper their intellectual development, this may be because of both, the attention granted to girls in rural

areas and availability of oppartunities condencive to proper intellectual growth. On the contrary a very low positive relationship between family size and intellectual development, in aided schools has been obserable which is not significant. It also represents an anomolous situation that may be due to sampling fluctuations.

Thus main findings may be concluded as below:

- children belonging to small sized family appear to derive more advantage with regards to their intellectual development, while children of large sized family seems to be disadvantageous. It holds good for the total, urban sample and groups of boys and girls and students in government and aided schools.
- girls from bigger families seem to be relatively more disadvantageous than boys with regards to their intellectual development.

Thus on the basis of above findings the hypothesis which states that:

"There is No Significant Relationship Between Intellectual Development Of Student And The Size Of Family ;"

is rejected.

Intellectual Development of General And SC/ST Students With Their Socio-Economic Back Ground

Table XLII reveals relationships of intellectual development of student of (i) general category and (ii) scheduled caste and scheduled tribes with (a) education of fathers'/mothers' (b) occupations of fathers'/mothers' (c) parents' income and (d) family size. These are discussed in the following paragraphs:

Education of fathers'/mothers' :

The coefficients of correlation between intellectual development and educational stuatus of parents' have been found from -0.065 to 0.349 for general/SC/ST students, For urban and total sample, parents' educational status contribute relatively more towards intellectual develop--ment of the students of general category as against their SC/ST counterparts.

In rural settings the mothers' education in general cagegory and fathers' education in SC/ST gcategory appeared to be more associated to the intellectual development of their children. Slight positive trend has been observed with regards to intellectual development of rural children vis-a-vis fathers' education in general category and mothers' education in SC/ST cetagory.

TABLE : XLII

COEFFICIENTS OF CORRELATION BETWEEN INTELLECTUAL DEVELOPMENT OF GENERAL AND SC/ST STUDENTS AND THEIR SOCIO ECONOMIC BACK GROUND

	EDUCATION		OCCUPATION		PARENTS	FAMILY
GENERAL STUDENTS	FATHER r	MOTHER r	FATHER r	MOTHER r	INCOME r	SIZE r
URBAN	0.284**	0.349**	0.254**	0.308**	0.485**	-0.151**
RURAL	0.112	-0.065	0.180*	-0.068	0.075	-0.068
TOTAL	0.273**	0.306**	0.256**	0.242**	0.420**	-0.175**
SC/ST STUDENTS						
URBAN	0.188	0.224*	0.175	0.203	0.328**	0.89
RURAL	0.091	0.115	0.432*	-0.325	0.342	0.001
TOTAL	0.185*	0.138	0.227	0.086	0.292**	0.129

* = .05 ; ** = .01 ; LEVELS OF SIGNIFICANCE.

The relationship were not significant even at .05 level of significance. Mothers' education in cases of SC/ST students in rural area seems to contribute relatively more than fathers' education towards the intellectual development of children, contrary to this in case of general category fathers' education play a dominant role in the intellectual development of their children.

Parents' occupation

Table XLII indicates that coefficient of correlation between parents (fathers'/mothers' occupation and intellectual development of the students range between -0.068 and 0.432.

A close struitiny of the table XLII reveals, that the contribution of the mothers' occupation in urban area and fathers' in rural area was relatively higher towards the intellectual development of their children belonging to either general or SC/ST .

Form the above observation it may be concluded that :

-parents' occupation was slightly more associated with intellectual development of the general students as compared to SC/ST students in total sample

Parents' income

It may be noticed from table XLII that coeficients of correlation between parents income and intellectual development of students were found to range between 0.075 to 0.485. It indicates that parents' income was positively related with intellectual development of students except in case of general students.of rural area where parents income and intellectual development of the students appeared to be independent .

So it may be concluded from the above observation that higher the income of the parents more likelyhood of attaining formal level of intellectual development. The table XLII also shows that the relationship of income with intellectual development was higher in case of general students than that of their SC/ST counterparts with regards to urban sample and total sample.

Size of the Family:

Table XLII further indicates coefficients of correlation between parents' income and intellectual development of the student, which range from -0.175 to 0.129. Intellectual development seems to be almost independent of family size in case of rural sample and also for SC/ST students of urban area. Very low negative correlations may be observed in case of general

candidates of urban and total sample, .. the increase in family size appears to hamper the intellectual development of the students of general category. On the contrary a very low positive relationship has been found between family size and intellectual development of SC/ST students, of total sample, which was not significant.

The main findings emerging out of the above discussions may be summerized as below:

> -bigger family size hampers the intellectual development of students of general category in relatively greater magnitude than SC/ST students. It may be due to the fact that their(general-category) consciousness with regard to implication of bigger family size was relatively higher as compared to their SC/ST counterparts.

On the basis of above findings the hypothesis which states that:

> "There is No Significant Relationship Between Intellectual Development of General and SC/ST Students And Their Socio-Economic Back Ground;"

is rejected.

DIFFERENCE IN THE COMPONENTS OF CREATIVITY OF VARIOUS GROUPS AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT

In order to test the significance of difference in creativity at different levels of intellectual development achievement in mathmatics science and aggregate achievement. 't' test for pair have been employed and the same is presented under the floowing headings:

(i) significance of difference in components of creativity of various groups.

(ii) significance of difference in achievement in mathematics science and aggregate achievement in all school subjects.

The differences have been studied for the urban rural and total sample have been presented as follows:

Various Groups Compared on Components of Creativity

In order to assess the significance of difference in components of non-verbal, verbal and total creativity between different groups of students at various levels of intellectual development with in urban, rural and total sample, 't' test of significance of differences

TABLE: XLIII

SHOWING SIGNIFICANCE OF DIFFERENCE ON CREATIVITY AMONG STUDENTS AT CONCRETE, TRANSITIONAL AND FORMAL LEVEL OF INTELLECTUAL DEVELOPMENT.

	TOTAL SAMPLE			URBAN			RURAL		
COMP. OF CREAT.	TRANS. Vs CONCRETE	FORMAL Vs CONC.	FORMAL Vs TRANS.	TRANS. VS CONC.	FORMAL Vs CONCREATE	FORMAL VS TRANS.	TRANS. vs CONC.	FORMAL Vs CONC.	FORMAL Vs TRANS.
NV Fl	4.83**	11.01***	8.27**	4.09**	10.07**	8.26**	2.06*	1.17	0.05
NV Fx	6.28**	13.96**	10.07**	4.84**	12.42**	9.93**	3.58**	1.83	0.10
NV Or	13.40**	23.57**	14.86**	11.37**	22.83**	14.73**	7.95**	3.77**	1.00
Totl NV	08.56**	18.44**	12.96**	07.12**	17.23**	13.00**	4.25**	2.44*	0.34
V Fl	07.90**	16.22**	10.87**	07.69**	15.78**	10.44**	1.42	1.85	1.16
V Fx	08.07**	18.40**	13.05**	06.68**	16.95**	12.97**	4.02**	2.70**	0.47
V Or	14.89**	27.21**	17.34**	13.37**	25.67**	16.55**	6.19**	7.82**	4.21**
Tot. V	11.78**	23.19**	15.30**	10.61**	22.04**	14.86**	4.27**	4.06**	1.96
Fl	07.88**	16.56**	11.33**	07.35**	15.84**	11.01**	2.11*	1.94	0.84
Fx	08.57**	19.53**	14.29**	07.05**	18.17**	14.46**	4.38**	2.69*	0.34
Or	17.89**	29.86**	18.97**	16.07**	28.79**	18.53**	8.13**	7.20**	3.34**
Total Creat.	12.35**	24.35**	16.39**	10.94**	23.25**	16.22**	4.99**	4.01**	1.51

* = .05   ** = .01 LEVEL OF SIGNIFICANCE

between means were applied. The obtain 't' values for groups have been presented under the following sub-headings.

Table XLIII indicates comparisions between three sets of intellectual development viz. transitional versus concrete, formal versus concrete and formal versus transitional for rural, urban and total samples in respect of various components of verbal, non-verbal and total creativity.

Careful examination of Table XLIII reveals that the 't' values ranged from 4.09 to 28.79. 0.10 to 08.13 and 4.83 to 29.86, for urban, rural and total sample, respectively for paired comparisions stated above.

For urban and total sample all 't' values were found to be significant at .01 level of significence It may be interpreted that students at transitional level of intellectual development differed significantly with their counterparts at concrete level of thinking. The students at formal level also differed significantly with concrete level students. At formal level, students were significantly different with transitional level students of verbal, non.verbal and total creativity. It seems fair to assert that

students at formal level of intellectual development were significantly superior to students at transitional and concrete levels and also that transitional level students were significantly superior than concrete level students with regard to verbal, non-verbal and total fluency total flexibility, total originality and total creativity.

In case of rural students slightly different pattern was observable. Transitional level students excelled their concrete level counterparts in elmost all components of verbal, non-verbal and total creativyty excepting for verbal fluency. Formal level students appeared to be better than transitional level counterparts with regard to non-verbal and total creativity in general and also in verbal flexibility and verbal originality and total verbal creativity. It may also be noticed that formal level students were found to be at a higher level with regard to verbal, non-verbal and total originality and total creativity along with verbal and total flexibility. While comparing formal with transitional level students one may find that there were non significant differences among them excepting verbal and total originality where transitional level students were seen lagging behind.

On the basis of the foregoing discussion of results following general conclusions seem to be evident.

- in urban and total samples formal level students were superior to transitional level students who were inturn superior to concrete level students when compared on various components of verbal, non-verbal and total creativity. Thus higher amount of creativity could be expected from formal level urban students and students in general.

- among rural students verbal, non.verbal and total originality was found to be highest among formal level students, seconded by transitional level students, followed by concrete level ones. Formal and transitional level students were found to be superior to concrete level students in almost all aspects of verbal, non-verbal and total creativity. but differences between transitional and formal level students existed only with regard to originality.

It seems appropriate to say that urban

environment appears to be favourable for the growth of creativity vis-a-vis intellectual development. In rural atmosphere their pappear to be a little opportinities for fluency and flexibility to grow alongwith intellectual development.

Thus on the basis of above findings the hypothesis which states that :

> "There is No Significant Difference Of Creativity Among The Students At Concrete, Transitional and Formal Level of Intellectual Development';

is rejected.

Boys and Girls :

Table XLIV shows 't' values of various components of creativity pertating to hoys and girls of urbam, rural and total sample at different levels of intellectual development. The 't' valued represented in the table ranged from .03 to 10.01, .09. 59 1.93 and 0.11 to 10.92 for urban, rural and total sample respectively.

A close scrutiny of the table would reveal

that there were significant differences between boys and girls with regard to components of verbal and total creativity, For urban and total samples, the girls appeared to be significantly better than boys so as verbal and total creativity were concerned. Girls also excelled their counterparts belonging to urban and total samples with regard to total non-verbal creativity in general and non-verbal fluency in particular.

However, no significant differences among boys and girls could be seen in rural settings. Girls at concrete level of intellectual development were found to be significantly better than boys with regard to verbal fluency, total fluency, total originality and total creativity in urban and total sample. No significant differences could be noticed between boys and girls, in the components of non-verbal creativity.

Transitional level girls appeared to possess relatively more amount of verbal, non-verbal and total fluency in urban and total sample, They were also found to be superior than boys with regard to verbal and total originality, verbal creativity and total creativity in urban and total sample.

TABLE: XLIV

SHOWING SIGNIFICANCE OF DIFFERENCE ON CREATIVITY BETWEEN BOYS AND GIRLS AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT.

COMP. OF CREAT.	URBAN CONC.	TRANS.	FORMAL	TOTAL	RURAL CONC.	TRANS.	TOTAL	TOTAL SAMPLE CONC.	TRANS.	FORMAL	TOTAL
NFl	-0.77	-3.36**	-3.44	-4.13**	0.78	1.76	1.93	-0.90	-3.66**	-3.91**	-4.77**
Fx	0.90	1.37	-0.94	0.83	0.97	0.83	1.87	-0.05	0.11	-1.70	-1.17
Or	0.10	0.37	0.94	0.59	-1.40	0.18	0.57	-1.18	-0.24	0.27	-1.01
Total	0.03	-0.73	-1.08	-1.03	0.53	1.23	1.77	-0.72	-1.52	-1.80	-2.65**
Fl	-4.23**	-10.24**	-4.40**	-10.01**	0.92	-0.08	1.09	-3.66**	-10.80**	-4.84**	-10.92**
Fx	0.21	-1.35	-0.13	-0.92	-1.37	-1.39	-0.94	-0.98	-2.44**	-0.92	-2.92**
Or	-1.40	-5.73**	-2.16*	-4.46**	0.35	-0.44	1.21	-2.23**	-7.02**	-2.72**	-6.25**
Total	-2.34**	-7.24**	-2.86**	-6.15**	0.09	-0.68	0.60	-2.83**	-8.31**	-3.46**	-7.80**
Fl	-3.22**	-9.03**	-4.60**	-9.02**	1.06	0.86	1.76	-2.93**	-9.44**	-5.11**	-9.92**
Fx	0.62	-0.20	-0.59	-0.21	-0.27	-0.45	0.36	-0.64	-1.58	-1.52	-2.49*
Or	-1.15	-4.32**	-1.14	-2.95**	-0.28	-0.27	1.10	-2.34*	-5.62**	-1.81	-4.84**
Total	-1.60	-5.62**	-2.51*	-4.76**	0.33	0.13	1.24	-2.27*	-6.68**	-3.21**	-6.32**

* =.05 ** = .01 LEVEL OF SIGNIFICANCE.

Significantly higher flexibility could also be noticed among transitional level girls of the total sample.

Formal operational level girls appeared to be significantly better at higher level than boys with regard to verbal, fluency, verbal originality and verbal creativity in urban and total sample. They did exceel boys in non-verbal fluency in total sample.

On the basis of above results it seems appropriate to infer that girls of urban area and the total sample possess relatively more verbal and non-verbal fluency at all levels on intellectual development, verbal originality, total verbal creativity and total creativity were also inabundance among girls of urban area. They appeared to be at per with cre tivity. However, verbal flexibility was still more in case of girls. In rural areas non discrimination could be made among creativity components of boys and girls at different levels of intellectual development.

Thus on the basis of the above findings the

hypothesis which states that :

'There is No Significant Difference of Creativity Among Boys And Girls of Rural Urban, and Total Sample';

is not accepted.

Government and Aided Schools:

Table XLV shows 't' values of favricus components of creativity pretaining students of government schools and aided schools at different level of intellectual development for urban and rural students and also for total sample. The 't' values represented in the table ranged from .10 to 5.85; .07 59 4.60 and 0.51 to 4.06 for urbam rural and total sample respectively. Positive (+) and negative (-) signs indicate bias in favour of government and aided schools respectively.

In urban sample differences between students of government and aided schools were found to be significant with regard to components of verbal and total creativity, where, aided school students appeared to be in advantageous position. However,

TABLE: XLV

SHOWING SIGNIFICANCE OF DIFFERENCE OF CREATIVITY BETWEEN STUDENTS OF GOVERNMENT AND AIDED SCHOOLS AT DIFFERENT LEVELS OF INTELLECTUAL DEVELOPMENT.

COMP. OF CREAT.	URBAN SAMPLE CONC.	TRANS.	FORMAL	TOTAL SAMPLE	RURAL SAMPLE CONC.	TRANS.	FORMAL	TOTAL	TOTAL SAMPLE
NV Fl	3.25**	-0.10	-3.67**	-0.18	0.58	0.09	0.07	0.55	-0.80
NV Fx	2.76**	1.17	-2.17**	0.73	1.33	1.34	0.79	2.08*	-0.20
NV Or	0.28	0.66	-2.78	-1.62	1.88	2.30*	1.21	2.69**	-2.15
NV Tot.	2.83**	0.67	3.30**	0.45	1.23	1.12	0.74	1.81	-1.21
V Fl	1.16	-1.22	-5.85**	-3.62**	-0.09	0.57	2.61*	1.11	-4.06**
V Fx	0.10	1.59	-2.26*	-0.48	2.97**	2.97**	3.18**	4.60**	-0.63
VO Or	-0.56	0.44	-3.27**	-2.13*	-0.39	0.83	1.23	0.37	-3.27**
VC Tot.	0.40*	0.08	-4.52**	-2.51*	0.83	1.57	2.57**	2.11*	-3.18**
Fl	2.40*	-0.96	-5.83**	-2.76**	0.26	0.43	1.79	1.04	-3.31**
Fx	1.54	1.73	-2.78**	0.03	2.42*	2.66**	2.18	3.92**	-0.51*
Or	-0.36	0.66	-3.54**	-2.16*	0.43	1.51	1.49	1.26	-3.17**
Total	1.65	0.36	-4.63**	-1.96*	1.18	1.62	2.07	2.28*	-2.71**

* = .05   ** = 0.01   LEVEL OF SIGNIFICANCE

the only deviation was observable in case of flexibility where 't' values were not significant.

In case of total rural sample all obtained 't' values appeared to favour government schools student as against aided school counterparts. Significant differences were observable for flexibility components of non-verbal, verbal and total creativity Also no significant differences could be seen with regard to components of non-verbal creativity of the students of government and aided schools.

Aided school students, especially belonging to urban area were found to possess higher level. of creativity at formal optional level while government school students excelled aided school counterparts at concrete level of intellectual development. It gives rise to a blief that aided urban schools provide relatively better environment for creative potential to grow at the highest level of intellectual development whereas in government schools creativity of concrete level students gets enhanced and at transitional level they appear to be at par with aided schools and with regard to further intellectual development they are hampred with their limitations.

For total sample, the 't' values indicated significant differences between government and aided schools with regard to verbal, non-verbal and total, non-verbal and total originality, verbal and total fluency, total non verbal creativity, and total creativity. The aided schools students seemsed to be better with regard to these characteristics.

At various levels of intellectual development of students in government and aided schools, the following was noticed:

Concrete level government school students appeared to be significantly better than aided school counterparts with regards to non-verbal and total fluency, non-verbal flexibility and total non-verbal creativity in urban areas and in verbal and total flexibility in rural areas. In rest of the components of creativity the government and aided schools students appeared to be alike.

Transitional level students of government and aided school of urban area did not demonstrate significant differences in various components of verba, non-verbal and total creativity. Rural area students of government schools indicated their superiority over

aided school students so far as non-verbal originality, and verbal and total flexibility were concerned.

Formal operational level appeared to distinguish between students of government and aided schools in various components of verbal and non-verbal and total creativity where 'urban' aided school students maintained their superiority all throrgh.

An opposite trend was found in rural settings where government school students were found to possess relatively more amount of verbal fluency, flexibility and total verbal creativity.

Thus on the basis of above findings the hypothesis which states that:

> "There is No Significant Difference of Creativity Among The Students Of Government And Aided Schools'.

is rejected.

TABLE : XLVI

SHOWING SIGNIFICANCE OF DIFFERENCE OF CREATIVITY BETWEEN STUDENTS OF GENERAL AND SC/ST CATEGORY STUDENTS OF URBAN, RURAL & TOTAL SAMPLES

COMP. OF CREAT.	URBAN	RURAL	TOTAL
NV Fl	1.83	0.26	2.38*
NV Fx	1.92	0.44	3.05**
NV Or	2.88**	0.73	3.66**
NV Tot.	2.55**	0.50	3.47**
V Fl	3.61**	-0.83	3.53**
V Fx	2.21*	0.36	3.09**
V Or	3.29**	-1.06	3.63**
Tot. V	3.47**	-0.64	3.82**
Fl	3.39**	-0.42	3.54**
Fx	2.44**	0.46	3.55**
Or	3.49**	-0.52	4.02**
Tot. Creat.	3.49**	-0.19	4.09**

* = .05 ** = .01 LEVEL OF SIGNAFICANCE.

General and SC/ST Students:

Table XLVI shows 't' values of various components of creativity pertaining general and SC/ST students of urban, rural and total sample. The 't' values reported in the table ranged from 1.83 to 3.49 0.19 to 1.06 and 2.38 to 4.09 for urban, rural and total sample respectively

For urban and total sample most of the 't' values were found significant excepting 't' value for non-verbal fluency and flexibility which were found in favour of general students but not significant

In case of rural sample most of the 't' values was found also not significant.

On the basis of above observations it seems fair to assert that students of general category were significantly superior to students of SC/ST category with regard to verbal, non-verbal and creativity, in urban and total sample. However, in rural area performance of SC/ST students was not different than general students.

Thus on the basis of above findings the

hypothesis which states that :

'There is No Significant Difference of Creativity Among General And SC/ST Students.'

is not accepted.

Various Groups Compared On Achievement :

Table XLVII shows 't' values of achievement in mathematics, science and aggregate achievement pertaining students of urban and rural areas, government and aided schools Boys and girls and general and SC/ST students. The 't' values represented in the table XLVII ranged from 2.49 to 6.45, 0.21 to 6.24, and 2.45 to 6.76 for boys and girls, students of government schools and aided schools general and aided schools and urban students and rural stidents, respectively positive (+) values indicate bias towards boys, students of government schools, students of general category, and urban sample.

Obtained 't' values indicate that boys, students of aided schools, general students and urban sample were significantly better than that of their, girls, students of government schools, SC/ST students and

TABLE XLVII

SHOWING SIGNIFICANCE OF DIFFERENCE
INACHIEVEMENT IN MATHEMATICS?
SCIENCE AND AGGREGATE ACHIEVEMENT
BETWEEN VARIOUS GROUPS

	BOYS V/S GIRLS	GOVERNMENT V/S AIDED SCHOOLS	GENERAL V/S SC/ST STUDENTS	URBAN V/S RURAL
	t-Value	t-Value	t-Value	t-Value
MATH	2.49*	-6.45**	2.64**	6.44**
SCIENCE	0.21	-6.29**	2.94**	6.11**
AGGREGATE	2.45*	-5.95**	3.18**	6.76**

LEVELS OF SIGNIFICANCE ; * = .05; ** = .01 ;

rural sample counterparts, with regard to achievement in mathematics, science and aggregate achievement. However, difference between boys and girls in achievement in science was not significant.

Thus on the basis of above finding the hypothesis which states that:

> 'There is No Significance Differences Among Boys and Girls, Students of Government and Aided, Students of General and SC/ST Category, And Urban and Rural Sample for Their Achievement in Mathematics, Science And Aggregate Achievement.'

is rejected.

C H A P T E R ; V

CONCLUSIONS, RECOMMENDATIONS AND SUGGESTED RESEARCH

CHAPTER - V

CONCLUSIONS RECOMMENDATIONS AND SUGGESTED RESEARCH

This chapter first presents the conclusions arrived at as a result of analysis and interpretations. Than, some of the possible ways in which the findings could be applied for promoting the abstract thoughts or reasoning and Creative thinking have been recommended. In the last, a few possible problems on which further research could be conducted have been suggested.

The focus of the study hav been on studying the relationship of intellectual development with creativity, achievement and socio-economic status of grade XI science students. The study was conducted through normative testing survey method following the cross-sectional approach, as such the nature of the study has been correlational type. Besides studying the relationships between intellectual development and various dimensions of creativity, an attempt was also made to study the effect of type of schools, sex, parents' education, parents' occupations, parents' income, size of the family and environmental influence on intellectual development. Comparisions among scheduled caste/scheduled tribes and general category students were also attempted vis-a-vis their intellectual development. Creativity and achievement of thestudent were also studied with regard to sex, environment and type of schools at various levels of their intellectual development. As a result of analysis and interpretation of data the investigator has been able to obtain some of the findings which are given below :

FINDINGS:

I Level Of Intellectual Development

-Formal operational level was not attained by majority of the adolescent sceince students.

- Majority of the students are at transitional level of intellectual development.

- In urban group percentage of students at formal operational level was higher than their counterparts in rural areas.

- Percentages of concrete operational thinker students was higher in rural areas than that of urban areas.

- At transitional operational level of intellectual development percentage of girls was slightly higher against boys inurban and total sample.

- Boys of aided schools were found in advantageous position to attain formal operational level against boys studying in government schools in urban and rural settings.

- Students of aided schools were found more at formal operational level against boys studying in government schools in urban and rural settings.

- Percentages of boys reached at concrete operational level of intellectual development was higher in case of aided schools against government schools in both urban and rural areas.
- Percentages of boys at transitional operationla l level was higher ingovernment schools than that of aided schools. While reverse was true for girls in urban areas.
- Percentage of general students at formal operation level was higher against SC/ST students in urban, rural and total sample.

II RELATIONSHIP

Intellectual Development with Creativity

- Creativity components namely, fluency, flexibility and originality were found to show higher relationship at formal level of intellectual development as compared to other two levels of students.
- Intellectual development of urban students was relatively more positively associated with various component of non-verbal, verbal and total creativity as against their rural counterparts.

- Intellectual development significantly related with creativity amongst boys and girls.
- Verbal creativity of subjects (boys and girls) was more closely associated with intellectual development than non-verbal creativity irrespective of their being in rural or urban schools.
- Intellectual development of students studying in aided scho ls was found to have relatively more positive associated with various components of non-verbal, verbal and total creativity than their government school counterparts.
- Boys and girls of urban area belonging to government, and aided schools were at advantage with regards to both creativity and intellectual development than their rural counterparts.
- General category students excelled than SC/ST counterparts both on non-verbal and verbal creativity vis-a-vis their intellectual development in rural as well as urban schools.
- Levels of intellectual development and components of creativity were progressing

- Boys at concrete and formal level of intellectual development were found to be more creative than girls.
- Levels of intellectual development of both sexes were found related with non-verbal verbal and total creativity.

Intellectual Development with Achievement in Mathmatics, Science and Aggregate Achievement.

- Degree of abstractiness at high school science increases with the study of mathematics to science.
- Boys were found gainer with regard to achievement in science and aggregate as compared with their girls counterparts at the same level of intellectual development .
- The girls were at advantageous position than boys in mathematics achievement vis-a-vis intellectual development.
- Achievement of students were related with their intellectual development in both type of schools in urban and rural areas.
- General category candidates appear to be

advantageous positions as against SC/ST

advantageous positions as against SC/ST candidates with regard to achievement vis-a-vis intellectual development.

- Environment of aided schools was found more favourable for students at concrete and formal operational levels of intellectual development for their achievement in mathematics than that of government school students.
- In aided schools of urban area and total sample concrete and formal operational levels of intellectual development was higher related with achievement in science than their government schools counterparts.

Intellectual Development of the Students and Socio-Economic Status of Parents

- Contribution of mothers' education was higher than that of fathers' education towards intellectual development of children and that it had relatively more influence on the children of the same sex as the parents.

- Higher occupation of parents leads to the likelyhood of attaining formal operation level by the children and vice-versa.
- Higher occupations of mothrs' contribute more in intellectual development of the children as compared with fathers' contribution in case of urban children.
- Contribution of parents' income waw higher towards intellectual development of the boys than that of girls.
- Children belonging to small sized family appear to derive more advantage with regards to their intellectual development.
- Girls from bigger families seem to be relatively more disadvantageous than boys with regards to their intellectual development.
- Parents' occupation was slightly more associated with intellectual development of the general students as compared to SC/ST students in total sample
- Relationship of Pparents' income with intellectual development was higher in case of general students than that of their SC/ST counterparts.

- Bigger family size hampers the intellectual development of students of general category in relatively greater magnitude than SC/ST students.

III DIFFERENCE

Creativity and Intellectual Development

- In urban and total samples formal level students were superior to transitional level students who were inturn superior to concrete level students when compared on various components of verbal, non-verbal and total creativity.
- In urual area formal level students were found to be highest on verbal , non-verbal and total originality than that of other two levels of intellectual development.
- Formal operational level girls were found to be better at higher level than boys with regard to verbal, fluency, verbal originality and verbal creativity and both urban and total sample.

Recommendations

The research of Jean Piaget might lead many educators to believe that 15 to 16 years of age individual attains Formal Operational Thinking or reasoning abilities. This is a misconception, as the findings of this study and many other researches on cognitive development indicate two broad trends. (i) The majority of the students function at concrete operational level on their understanding of science subject matter. (ii) Those who can function at the Formal level also tend to function at the concrete level.

These results have direct bearings on the curriculum planners for adolescent pupils as well as on teachers and educators indeciding the teaching strategies and type of environment needed for expression of creative strength.

The selection of content or concepts for XI grade science students should be organised according to the developmental level of the Intellectual Development or mental growth of the children. In otherwords, a large number of concrete level concepts and few number of Formal Concepts should be choosen. The concepts in order of their complexities from concreteness to abstractness should be introduced in conformity with the logical operations developed in the children.

As Raven has aptly remarked that:

> A concept will not be acquired if the logical organisation of the concept is more complex than the pupil's logical operations. Once the pupil's level of logical organisation has been assessed the teacher can provide him with a conceptual structure that he can assimulate. The teacher can readesign the logical structure of an entire concept or parts of a concept for a student after the cognitive ability of the student has been determined.

Besides, selecting a balanced curriculum based on concept- logical operation continum. The equally important need for rethinking is for the Free and congeneal environment in the schools. Freedom and Creativity go together. Any restriction can block the creative expression of children or even their intellectual abilities. A proper balance be kept between emotional and intellectual growth, if a child is found to be restricted in his creative expression and yet highly developed reasoning abilities, he must be given motivation to maintain the equilibrium. If a child is found to be rich in novel ideas and creative thinking but otherwise seemingly below his intellectual achievements.

It is just as important for the adolescent children to gain freedom in expression as it is for him to get more knowledge. In fact, the knowledge will remain unused,

frozen, unless the child develops the urge and the freedom to use it creatively.

Suggested Research

An effective programme of research must strive to help the young researcher to visualize the vast domain of untackled problems, which may have little or more similarity with the areas already explored by the past researchers. It is admitted that such a process would link the past and the present knowledge to establish the better future. Therefore, the need of further research in the field of education arises day by day.

Having reviewed the result of the present study, the investigator realised that these can be a number of research studies which can be taken under this vital area of intellectual development.

1. The study needs to be replicated on a sample.
2. an investigation into the factors/conditions affecting the level of intellectual development.
3. Piagetian Tasks and other tests prepared for the measurement of logical reasoning be used and the results may be compared.
4. Similar studies may be repeated for IX,X class and college students.

5. Longitudinal studies for the development of adolescent thought may be undertaken.
6. A study of Tests content analysis between Piagetian Tasks and Creativiey Test Tasks may be attempted using Factor analytical approach.
7. Study of Intellectual development and Creativity may be repeated by controlling the effect of intelligence or other mental abilities.
8. Intellegence, cultural and Personality effects on the Adolescent Thought may be undertaken for future investigations.

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SUMMARY

"RELATIONSHIP OF INTELLECTUAL DEVELOPMENT WITH CREATIVITY, ACHIEVEMENT AND SOCIO-ECONOMIC STATUS OF XI-GRADE SCIENCE STUDENTS

INTRODUCTION :

The researches on the development of intellect and Creative expression of children are gradually becoming an important areas of concern for educators and psychologist. Cognitive development work is always associated with Jean Piaget, the Chief advocate of Geneva School of Thought, while the significant and recent upsurge of interest in creativity and creative thinking is primarily a result of Guilford's work.

However, the attention has often been divided. Piaget stressed the need for reasoning skills necessary to an adequate understanding of concepts. In contrast the propenents of creativity have often stressed the nd need for divergent thinking or even the irrational thinking for attainment of new and novel ideas.

Piaget by use of symbolic logic has initiated a long term programme to chart the stages of child's progress toward adult model of thought. The order of

succession of these stages is invariate. These stages are characterised by overall structures in terms of 'Schemes' or 'Operations', which are integrative and non-interchangable. He has defined four stages of cognitive development the sensori-motor, pre-operational Concrete operational and the formal operational stage.

Piaget says that children develop their thinking through interaction with their environments and pass through various stages before reaching maturity in their thinking and development. All children pass through stages of development invariably in the given order, but the age at which any stage will be reached depends upon factors within the individual i.e. biological and psychological and upon factors in the social and physical environment.

Piaget's theory of cognitive development has much relevance to the concept of creativity. The very principles that Piaget defines as basic to the process of intelligence are also related to the creative process. He described a process whereby creativity and intelligence nourish each other, and through their interaction, produce

intelligent activity at even more advance levels.

IN DEFENCE OF THESTUDY:

One of the crippling obstacles in the path of development is the fact that quantity is almost always more obvious, more visible, more conspicuous than quality. The stress on evolving the students general capabilities as a formulator and solver of problem rather than his ability to serve as a depository of facts is especially important in the context of a developing country.

However, little research efforts seem to have been made to study the influence of intellectual development on the development of creativity. It is, especially, a virgin field with regard to the study of adolescents' understanding of the science studies vis-a-vis their socio-economic background and the learning environments in which they are placed.

The present investigator could find a few studies only like that of stoker (1972), Reven and Polanki(1974), Lehman et.al.(1980) indicating the possibility of relationship between level of cognitive development and creativity. At home

(India) most of the researches focussed on the studies of cognito and non-cognito factors of creativity only a few studies have attempted to investigate the relationship between hypotheses testing ability in problem solving and creativity (Mishra 1973, Vaidya 1975; Grewal 1978; Jain 1981) by using Piagetian tasks. Need for an indepth study of possible relationships of intellectual development of the adolescent science students with their creative performance taking into account the academic achievement and some important environmental factors both at home and in school is self-evident. The present piece of research attempts to fill in this gap.

Purpose of the Study

The study of XIgrade science students was taken up with the following objectives:

1. To classify the rural and urban students on the basis of various levels of intellectual developm development.
2. To identify boys and girls at different levels of intellectual development.

3. To identify the science students of XI grade accoring to their levels of intellectual development and categoriese them into (i) concrete operational (ii) transitional operational and (iii) formal operational thinkers.

4. To classify the scheduled caste nd non-scheduled caste students on the basis of various levels of intellectual development.

5. To find out the relati nships between various levels of intellectual development with verbal, non-verbal and creativity scores.

7. To find out relationships between parents' education and intellectual development of students.

8. To find out the relationship between parents' occupations and intellectual develo.ment of students.

10 To study the impact of family size on intellectual development of students.

11. To compare the sex difference on creativity scores at different levels of intellectual development.

12. To compare the rural andurban students at various levels of intellectual development on the basis of creativity scores.

13. To compare the government and government aided students at various levels of intellectual development on the basis of creativity scores.

14. To establish relationship between the levels of intellectual development, viz (i) concrete operational, (ii) transitional operational and (iii) formal operational, and achievement in (a) science subjects (b) mathematics and (c) aggregate scores of all school subjects.

15. To compare boys-girls, government-aided, rural-urban and general-SC/ST groups on the basis of their achievement in (i) Mathematic, (ii) Science and (iii) Aggregate achievement.

16. To compare general and SC/ST students with regard to (i)Education of father and mother (ii) Occupation of father and mother (iii) Parents' income and (iv) Size of the family.

A S S U M P T I O N S

The present piece of research rests on the following assumptions which helped in formulating and executing theplan of the study.

1. The students of Government and Government aided institutions come from almost similar backnrounds and also these schools are comparable so far as the learning environment and facilities are concerned.

2. The statements of students regarding parents imcome onthe General Information Questionarie have been considered to be the realistic measure of parents' income/education although not fully authenticated.

3. In the present investigation only three components of creativity viz. Fluency, flexibility and Originality have been taken into account. Elaboration has, however, not been considreed appropriate in the present context.

4. Rural/urban and government/aided school nomenclature has been adopted from the list of schools provided by the Delhi Administration.

5. Scheduled caste have been treated on the basis of students' disclosure.

6. Group assessment of logical thinking by Michael J. Padilla et.al. has been used to measure the intellectual development in both English and Hindi. In Hindi version the institutions and names of persons objects were changed. The usability of the test was, however, ascertained by way of experts' judgement.

8. Creativity has been measured with the Hindi version of Torrence Test of Creative Thinking (TTCT), which is already in use in India.

9. Class X public examination marks have been considered as a measure of scholastic achievement of students.

10. Assumption nderlying statistical techniques used would naturally constitute the basis for drawing conclusions for the present study.

METHODOLOGY

The focus of the study has been on studying the relationship of intellectual development with creativity, achievement and socio-economic status of grade XI science students. The study waw conducted through normative testing survey method following the cross-sectional approach, as such the nature of the study has been correlational type. Besides studying the relationships between intellectual development and various dimensions of creativity, an attempt was also made to study the effect of type of schools, sex, parents, education, parents' occupations, parent's income, size of the family and environmental influence on intellectual development. Comparisions among scheduled caste/ scheduled tribes and general category students were also attempted vis-a-vis their intellectual development. Creativity and achievement of the student were also studied with regard to sex, environment and type of schools at various levels of their intellectual developmant.

SAMPLING

THE sample of the present study consisted of (656 boys and 370 girls) students offering science subjects at grade XI, drawn from the senior secondary schools f of Union Territory, Delhi. All subjects belonged to age group (15-17) years. Stratified cluster sampling technique (Festinger and Katz, 1970) was employed.

DELIMINATIONS OF THE STUDY

The present study was delimited with regard to its area, method, sampling, tools and satistical techniques. These are presented below:

1. The study has focused on the relationship of intellectual development and creativity achievement and socio-economic status has been conducted through normative testing survey method. The intellectual development has been undertaken at three stages namely (i) Concrete operational (ii) Transitional operational and (iii) Formal operational.

2. Group assessment of logical thinking , Torrence Test of creative thinking and general information questionarie were administered on boys and girls of government and aided schools of rural and urban area.

HYPOTHESIS

In accordance with the objectives of the study following hypotheses were formulated:

1. Majority of the science adolescent students are at formal operational level of intellectual development
2. Percentage of both Sexes different levels of intellectual development are equal in government and aided schools.
3. Percentage of both general and SC/ST categories students are equal at different levels of intellectual development.
4. There is no significant relationship between levels of intellectual development and creativity
5. There is no significant relationship between intellectual development and creativity in Urban and rural sample
6. There is no significant relationship between creativity and intellectual development of boys and girls
7. There is no significant relationship between components of creativity and intellectual development of boys and girls of urban and rural areas.

8. There is no significant reltionship between intellectual development of students of government and aided schools

9. There is no significant relationship between creativity and intellectual development of students of government and aided schools in urban and rural areas.

10 There is no significant relationship between creativity and intellectual development of boys and girls studying in government and aided schools in urban and rural areas.

11. There is no significant relationship between creativity and intellectual development of general and SC/ST students

12. There is no significant relationship between creativity and levels of intellectual development of students of urban and rural areas .

13. There is no significant relationship between creativity and intellectual development of boys and firls.

14. There is no significant relationship between creativity and levels of intellectual development of students of government and aided schools.

15. There is no significant relationship between creativity and intellectual development of gener l and SC/ST students.

16. There is no significant relationship between achievement in mathema.ics science and a..regate achievement

17. There is no significant relationship between achievement in mathematics science and aggregate achievement and intellectual development of students.

18. There is no significant relationship between achievement (in science, mathematics and aggregate) and intellectual development of boys and girls in government and aided schools or urban and rural areas.

19. There is no significant relationship between achievement(in mathematics, science and aggregate) and intellectual development of general and SC/ST students.

20. There is no significant belationship between achievement in kathematics and levels of intellectual development of science students.

21. There is no significant relationship between achievement in mathematics and intellectual development of students in government and aided schools of urban and rural areas.

22. There is no significant relationship between achievement in science and intellectual development of boys and girls.

23. There is no significant relationship between achievement in science and levels of intellectual development of students of government and aided schools .

24. There is no significant relationship between levels of intellectual development of the students with their aggregate achievement scores.

25. There is no significant relationship between aggregate achievement and levels of intellectual development of students of government and aided schools.

26. There is no significant relationship between intellectual development of students and education of parents.

27. There is no significant relationship between intellectual development of the students and occupation of parents.

28. There is no significant relationship between intellectual development of students and their parents' income.

29. There is no significant relationship between intellectual development of students and the sizi of family .

30. There is no significant relationship between intellectual development of general and SC/ST students and their socio-economic back ground.

31. There is no significant difference of creativity among the students at concrete, transitional and formal level of intellectual development .

32. There is no significant difference of creativity among boys and girls of rural urban and total sample.

33. There is no significant difference of creativity among the students of government and aided schools.

34. There is no significant difference of creativity among general and SC/ST students.

35. There is no significance differences among boys and girls, students of government and aided, students of general and SC/ST category, and urban and rural sample for their achievement in mathematics, science and aggregate achievement.

FINDINGS;

I Level Of Intellectual Development

- Formal operational level was not attained by majority of the adolescent sceince students.
- Majority of the students are at transitional level of intellectual development.
- In urban group percentage of students at formal operational level was higher than their counterparts in rural areas.
- Percentages of concrete operational thinker students was higher in rural areas than that of urban areas.
- At transitional operational level of intellectual development percentage of girls was slightly higher against boys inurban and total sample.
- Boys of aided schools were found in advantageous position to attain formal operational level against boys studying in government schools in urban and rural settings.
- Studentc of aided schools were found more at formal operational level against boys studying in government schools in urban and rural settings.

- Percentages of boys reached at concrete operational level of intellectual development was higher in case of aided schools against government schools in both urban and rural areas.
- Percentages of boys at transitional operationla l level was higher ingovernment schools than that of aided schools. While reverse was true for girls in urban areas.
- Percentage of general students at formal operation level was higher against SC/ST students in urban, rural and total sample.

II RELATIONSHIP

Intellectual Development with Creativity

- Creativity components namely, fluency, flexibility and originality were found to show higher relationship at formal level of intellectual development as compared to other two levels of students.
- Intellectual development of urban students was relatively more positively associated with various component of non-verbal, verbal and total creativity as against their rural counterparts.

- Intellectual development significantly related with creativity amongst boys and girls.
- Verbal creativity of subjects (boys and girls) was more closely associated with intellectual development than non-verbal creativity irrespective of their being in rural or urban schools.
- Intellectual development of students studying in aided schools was found to have relatively more positive associated with various components of non-verbal, verbal and total creativity than their government school counterparts.
- Boys and girls of urban area belonging to government, and aided schools were at advantage with regards to both creativity and intellectual development than their rural counterparts.
- General category students excelled than SC/ST counterparts both on non-verbal and verbal creativity vis-a-vis their intellectual development in rural as well as urban schools.
- Levels of intellectual development and components of creativity were progressing

- Boys at concrete and formal level of intellectual development were found to be more creative than girls.
- Levels of intellectual development of both sexes were found related with non-verbal verbal and total creativity.

Intellectual Development with Achievement in Mathmatics, Science and Aggregate Achievement.

- Degree of abstractiness at high school science increases with the study of mathematics to science.
- Boys were found gainer with regard to achievement in science and aggregate as compared with their girls counterparts at the same level of intellectual development .
- The girls were at advantageous position than boys in mathematics achievement vis-a-vis intellectual development.
- Achievement of students were related with their intellectual development in both type of schools in urban and rural areas.
- General category candidates appear to be

advantageous positions as against SC/ST

advantageous positions as against SC/ST
candidates with regard to achievement vis-a-vis intellectual development.

- Environment of aided schools was found more favourable for students at concrete and formal operational levels of intellectual development for their achievement in mathematics than that of government school students.
- In aided schools of urban area and total sample concrete and formal operational levels of intellectual development was higher related with achievement in science than their government schools counterparts.

Intellectual Development of the Students and Socio-Economic Status of Parents

- Contribution of mothers' education was higher than that of fathers' education towards intellectual development of children and that it had relatively more influence on the children of the same sex as the parents.

- Higher occupation of parents leads to the likelyhood of attaining formal operation level by the children and vice-versa.
- Higher occupations of mothrs' contribute more in intellectual development of the children as compared with fathers' contribution in case of urban children.
- Contribution of parents' income waw higher towards intellectual development of the boys than that of girls.
- Children belonging to small sized family appear to derive more advantage with regards to their intellectual development.
- Girls from bigger families seem to be relatively more disadvantageous than boys with regards to their intellectual development.
- Parents' occupation was slightly more associated with intellectual development of the general students as compared to SC/ST students in total sample
- Relationship of Pparents' income with intellectual development was higher in case of general students than that of their SC/ST counterparts.

- Bigger family size hampers the intellectual development of students of general category in relatively greater magnitude than SC/ST students.

III DIFFERENCE

Creativity and Intellectual Development

- In urban and total samples formal level students were superior to transitional level students who were inturn superior to concrete level students when compared on various components of verbal, non-verbal and total creativity.
- In urual area formal level students were found to be highest on verbal , non-verbal and total originality than that of other two levels of intellectual development.
- Formal operational level girls were found to be better at higher level than boys with regard to verbal, fluency, verbal originality and verbal creativity and both urban and total sample.

- Formal operational level appeared to distinguish between students of gov rnment and aided schools in various components of verbal and non-verbal and total creativity where 'urban' aided school students maintained their superiority all through.
- Boys , students of aided schools, general students and urban sample were significantly better than thatof their, girls students of government schools, SC/ST students and rural counterparts, with regard to achievement in mathematics, science and aggregate achievement, however, difference between boys and girls in achievement in science was not significant.

Suggesstions for Further Research

It is felt that the subject under study needs further researchers. Some of the factor like intelligence and personality, which h ve not been included in this investation, may be take up for further study the present study provides dimensions for further research needed in the following areas:

1. The study needs to be replicated on a large sample to confirm the findings of the present study.

2. An investigation into Factors/Conditions affecting the levels of intellectual development.

3. Piagetian Tasks and other Tests for assessing the logical Operations be used and the results may be compared with the present study.

4. A study of Tests content Analysis between Piagetian Tasks and Creativity Test Tasks may be attempted, using Factor analytical approach.

5. Study of Intellectual development and Creativity may be repeated by controling the effect of intelligence.

6. Intelligence, culture and Personality effects on the Adolescent Thought may be undertaken for future investigation.

Appendix - IX

ONLY FOR RESEARCH WORK.

सामूहिक परीक्षण- तार्किक विचार प्रक्रिया

GROUP TEST OF LOGICAL THINKING
(G A L T)

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TEST BOOKLET
परीक्षण - पुस्तिका

कृपया इस परीक्षण -पुस्तिका पर कुछ भी न लिखें ।

निर्देश:

1. इस परीक्षण पुस्तिका में कुल 12 विषयों पर चर्चा की गई है ।

2. विषय 1-10 तक में प्रयोग चर्चा के बाद एक प्रश्न पूछा गया है, जिसके नीचे संभावित उत्तर दिये गये हैं । जिनमें से केवल एक ही सही है तथा संभावित उत्तरों के नीचे कुछ कारण दिये गये हैं ।

3. आपको विषय 1-10, प्रत्येक को क्रम से पढ़कर सम्भावित उत्तरों में से सर्वोत्तम उत्तर का चयन करना है तथा उस उत्तर को चयन करने के कारण को चुनना है.

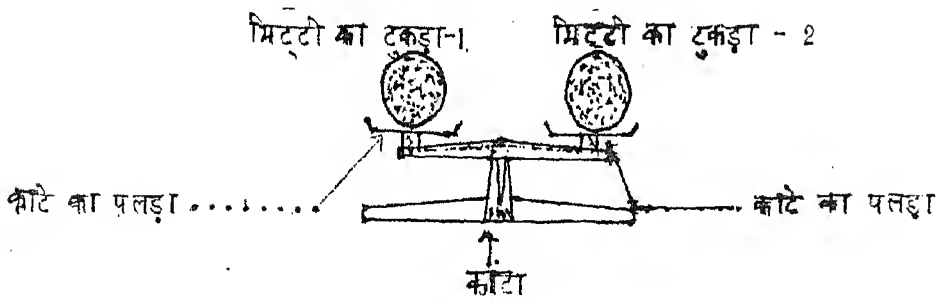
4. आप चुने गये सर्वोत्तम उत्तर के वर्ण (अ, ब, स, द) एवं उसके चुने जाने के कारण की संख्या (1, 2, 3, 4) को अलग से दिये गये उत्तर पृष्ठ पर विषय के सामने दिये गये स्थान पर लिखिये ।

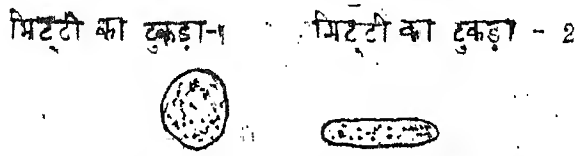
5. विषय 11 में, संभावित जोड़ी तथा विषय 12 में संभावित क्रमों को सोचकर उत्तर पृष्ठ पर दिये गये स्थानों पर लिखिये ।

विषय : ।

मिट्टी का टुकड़ा

राम के पास दो मिट्टी की गेंदे है । वे दोनों आकार एवं आकृति में समान हैं । जब उसने उन्हें कांटे के पलड़ों पर रखा तो उनका भार भी समान निकला ।





अब उसने मिट्टी की गेंदो को कांटे के पलड़ों से अलग हटा लिया तथा दूसरी गेन्द को प्लेट के समान चपटा कर लिया ।

प्रश्न: निम्न में से कौन सा कथन सत्य है ?

अ. प्लेट की आकृति के मिट्टी के टुकड़े का भार अधिक है ।

ब. दोनों मिट्टी के टुकड़ों का भार समान है ।

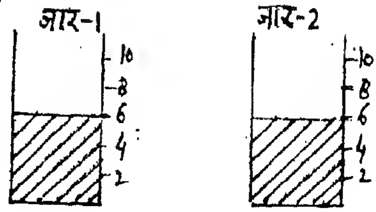
स. गेंद की आकृति के मिट्टी के टुकड़े का भार अधिक है ।

कारण: ।·

1. न तो और मिट्टी को मिलाया गया है और न ही मिट्टी निकाली गयी है.
2. जब मिट्टी की गेंद - 2 को प्लेट आकृति के समान चपटा किया तो इसका क्षेत्रफल अधिक हो गया ।
3. जब किसी वस्तु को चपटा किया जाता है तो इसका भार कम हो जाता है.
4. इसके घनत्व के कारण, गोल गेंद में अधिक मिट्टी है ।

विषय: 2 धातु भार

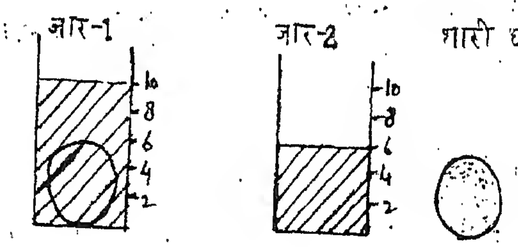
सीता के पास दो जार है। वे समान आकार तथा आकृति के हैं। दोनों में समान मात्रा में पानी भरा गया है।



उसके पास दो समान आयतन के धातु भार भी है। जिनमें से एक हल्का तथा दूसरा भारी है।

हल्का धातु भार भारी धातु भार

वह हल्के धातु भार को जार-1 में डुबोती है। जिससे जार-1 में पानी का तल बढ़ जाता है जो कि इस प्रकार दिखाई देता है :-



प्रश्न: भारी धातु भार को जार-2 में डुबोने पर क्या होगा ?

अ. पानी का तल जार – 1 की अपेक्षा कुछ अधिक बढ़ेगा।

ब. पानी का तल जार – 1 की अपेक्षा कुछ कम बढ़ेगा।

स. पानी का तल जार -1 के समान बढ़ेगा।

कारण:

1. दोनों भार समान आकार के हैं अतः वे समान मात्रा में स्थान लेंगे।

2. जितना अधिक धातु भार भारी होगा उतना ही अधिक पानी का तल बढ़ेगा।

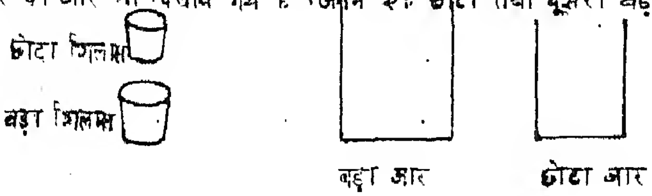
3. भारी धातु-भार का दबाव अधिक होता है, अतः पानी का तल कम बढ़ेगा।

4. जितना अधिक धातु-भार भारी होगा उतना ही कम पानी का तल बढ़ेगा।

विषय: 3

गिलास-आकार

चित्र में दो गिलास दिखाये गये है जिनमे एक छोटा तथा दूसरा बड़ा है । यहाँ पर दो जार भी दिखाये गये है जिनमे एक छोटा तथा दूसरा बड़ा है ।



बड़े जार को पूरा भरने के लिए 15 छोटे गिलास या 9 बड़े गिलास पानी की आवश्यकता होती है । छोटे जार को पूरा भरने के लिए 10 छोटे गिलास पानी की आवश्यकता होती है ।

प्रश्न: इस छोटे जार को पूरा भरने के लिए कितने बड़े गिलास पानी की आवश्यकता होती है ?

अ. 4

ब. 5

स. 6

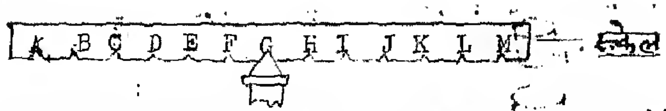
द. अन्य

कारण:

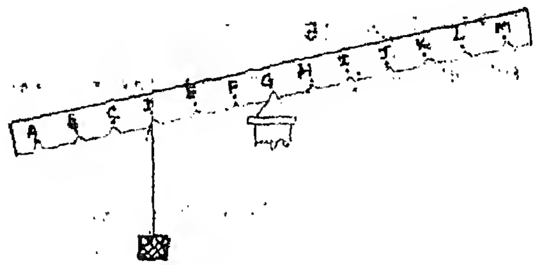
1. छोटा जार भरने के लिए पाँच छोटे गिलास पानी की कम आवश्यकता होती है । इसलिए इस जार को भरने के लिये पाँच बड़े गिलास पानी की कम आवश्यकता होगी ।
2. छोटे और बड़े गिलास में अनुपात सदैव 5:3 का होगा ।
3. छोटा गिलास आकार में बड़े गिलास का आधा है अतः छोटे जार को भरने के लिए, छोटे गिलासों की संख्या का लगभग आधे बड़े गिलास पानी चाहिये ।
4. यहाँ पर अनुमान करना सम्भव नहीं है ।

स्केल

मोहन के पास नीचे दिये गये चित्र के समान एक स्केल है.



जब वह एक दस-इकाई भार को 'D' बिन्दु पर लटकाता है तो स्केल निम्नवत् दिखाई देता है.:



प्रश्नः स्केल को संतुलित करने के लिए उसे पांच इकाई-भार को किस बिन्दु पर लटकाना चाहिए ?

अ. J बिन्दु पर

ब. K और L बिन्दु के मध्य

स. L बिन्दु पर

द. L और M बिन्दु के मध्य

य. M बिन्दु पर

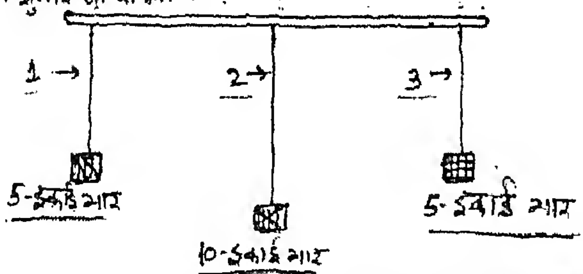
कारणः

1. यह आधा भार है अतः इसे दो-गुनी दूरी पर रखना चाहिए ।
2. दस-इकाई भार के बराबर दूरी पर, परन्तु विपरीत दिशा में.
3. छोटा भार होने की कमी को दूर करने के लिए पांच-इकाई भार को अधिक दूरी पर लटकाना चाहिए ।
4. सबसे दूर अंत में लटकाने से वह स्केल को संतुलित करने में अधिक सहायता मिलती है ।
5. जितना भार हल्का हो उसे उतनी ही अधिक दूर लटकाना चाहिए ।

विषय : 5

दोलक - लम्बाई

एक छड़ पर तीन डोरियाँ लटक रही है । डोरी संख्या 1 और 3 समान लम्बाई की हैं । डोरी संख्या 2 लम्बी है । मोहन ने डोरी संख्या 1 तथा 3 के अन्त में पाँच-इकाई भार लटकाये तथा एक दस-इकाई भार डोरी संख्या 2 से लटकाया । प्रत्येक डोरी भार के साथ झुलाई जा सकती है



मोहन यह पता लगाना चाहता है कि क्या डोरी की लम्बाई इसके आगे-पीछे झूलने के कुल समय पर प्रभाव डालती है ? इसको ज्ञात करने के लिये,

प्रश्न : वह किस डोरी तथा भार को अपने प्रयोग के लिए उपयोग करेगा ?

अ. डोरी संख्या 1 और 2

ब. डोरी संख्या 1 और 3

स. डोरी संख्या 2 और 3

द. डोरी संख्या 1, 2, और 3

य. केवल डोरी संख्या 2

कारण: 1. डोरियों की लम्बाई समान तथा भार भिन्न-भिन्न होने चाहिये ।

2. भिन्न-भिन्न लम्बाइयों का भिन्न-भिन्न भारों के साथ परीक्षण करना चाहिए ।

3. सभी डोरियों और उनके भारों का एक दूसरे के सापेक्ष परीक्षण करना चाहिए ;

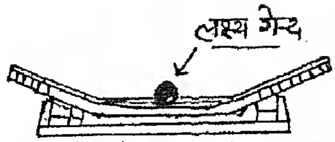
4. केवल सबसे लम्बी डोरी के साथ परीक्षण करना चाहिए; क्योंकि प्रयोग का संबंध लम्बाई से है भार से नहीं

5. लम्बाई के अतिरिक्त सभी चीजें समान होनी चाहिए तभी आप पता लगा सकते हैं कि लम्बाई का कुछ प्रभाव पड़ता है ।

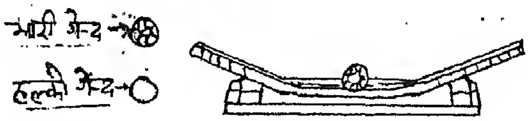
विषय – 6

गेंद

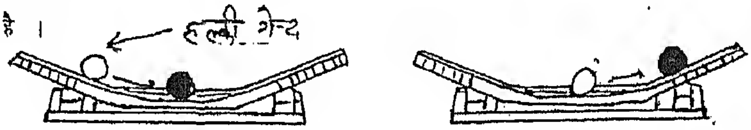
मोहन के पास एक गोलाई वाला ढाल है । ढाल के तले पर एक गेंद है, जिसे लक्ष्य गेंद कहते है ।



उसके पास दो गेंदे है जिनमें से एक भारी तथा दूसरी हल्की है । वह गेंद को ढाल पर नीचे लुढ़का सकता है जो कि लक्ष्य गेंद से टकराकर उसे दूसरी दिशा में ऊपर की ओर धकेल सकती है । अगर वह चाहे तो गेंदो को दो विभिन्न बिन्दुओं, एक उच्च तथा दूसरा निम्न से लुढ़का सकता है ।



मोहन हल्की गेंद को निम्न बिन्दु से छोड़ता है । वह ढाल पर नीचे की ओर लुढ़कती है तथा लक्ष्य गेंद से टकराकर उसे ढाल पर दूसरी तरफ ऊपर की ओर धकेल देती है ।



वह ज्ञात करना चाहता है कि क्या गेंद के छोड़े जाने वाले बिन्दुओं की स्थिति (उच्च या निम्न) लक्ष्य गेंद के लुढ़कने पर चली गई दूरी पर कोई प्रभाव डालती है ?

इसका परीक्षण करने के लिए उसे किस गेंद को उच्च बिन्दु से लुढ़काना चाहिए?

अ. भारी गेंद को

ब. हल्की गेंद को

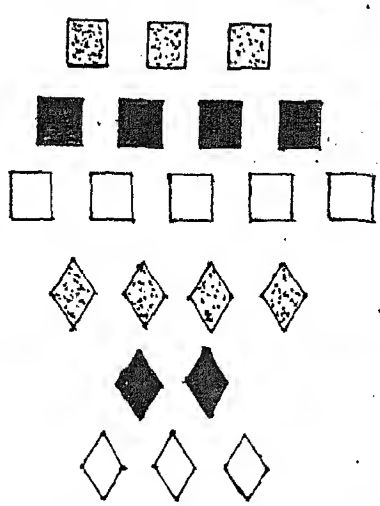
कारण :

1. उसने प्रयोग हल्की गेंद से शुरू किया था अतः इसी से समाप्त करना चाहिये ।
2. उसने पहले हल्की गेंद का उपयोग किया है अतः अब उसे भारी गेंद का उपयोग करना चाहिये ।
3. भारी गेंद अधिक बल से लक्ष्य गेंद से टकराकर उसे अधिक दूर ले जायेगी ।
4. उचित प्रयोग करने के लिये उसे हल्की गेंद को उच्च बिन्दु से लुढ़काना चाहिये ।
5. एक ही गेंद का उपयोग करना चाहिये क्योंकि प्रयोग में गेंद के भार को महत्व नहीं दिया गया है ।

वर्ग तथा समचतुर्भुज टुकड़े — 2

क्रिया : 8

एक टाट पर निम्नवत् विभिन्न टुकड़े लगे हैं :



3 लकड़ी के धब्बेदार वर्ग

4 लकड़ी के काले वर्ग

5 लकड़ी के सफेद वर्ग

4 लकड़ी के धब्बेदार समचतुर्भुज

2 लकड़ी के काले समचतुर्भुज

3 लकड़ी के सफेद समचतुर्भुज

सभी वर्गाकार टुकड़े समान आकार एवं आकृति के हैं तथा सभी समचतुर्भुज भी आपस में समान आकार एवं आकृति के हैं।

सबसे पहले जिस टुकड़े को छुओ उसे ही निकाल लीजिए। इस तरह से —

प्रश्न: एक धब्बेदार समचतुर्भुज या एक सफेद समचतुर्भुज के निकाले जाने की क्या सम्भावनायें हैं?

अ. 3 में से 1

ब. 9 में से 1

स. 21 में से 1

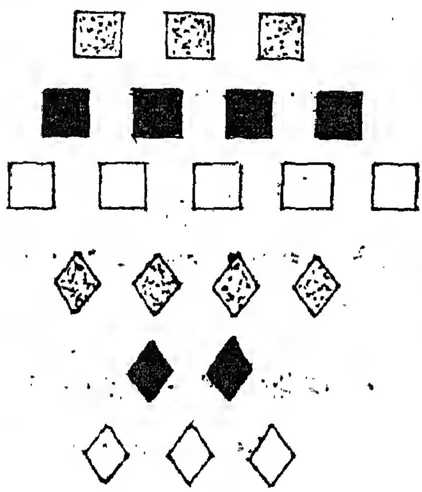
द. 21 में से 9

य. अन्य

कारण :

1. कुल इक्कीस टुकड़ों में से सात टुकड़े धब्बेदार या सफेद हैं।
2. धब्बेदार टुकड़ों की संख्या का 4/7 तथा सफेद टुकड़ों की संख्या का 3/8 समचतुर्भुज टुकड़ों का है।
3. कुल इक्कीस टुकड़ों में से नौ टुकड़े समचतुर्भुज हैं।
4. टाट पर लगे कुल इक्कीस टुकड़ों में से एक समचतुर्भुज टुकड़े का चुना जाना आवश्यक है?
5. उस टाट पर दो समचतुर्भुज टुकड़े हैं। अतः उनमें से एक को अवश्य चुना जाना चाहिए।

एक टाट पर निम्नवत् विभिन्न टुकड़े लगे हैं :



3 धब्बेदार वर्ग

4 लकड़ी के काले वर्ग

5 लकड़ी के सफेद वर्ग

4 लकड़ी के धब्बेदार समचतुर्भुज

2 काले समचतुर्भुज

3 सफेद लकड़ी के समचतुर्भुज

सभी वर्गाकार टुकड़े समान आकार एवं आकृति के हैं । सभी समचतुर्भुज भी आपस में समान आकार एवं आकृति के हैं । एक टुकड़े को टाट से उठा लिया जाता है ।

प्रश्न: इसके धब्बेदार टुकड़ा होने की क्या संभावनायें हैं ?

अ. 3 में से 1

ब. 4 में से 1

स. 7 में से 1

द. 21 में से 1

य. अन्य

कारण :

1. टाट पर कुल इक्कीस टुकड़े हैं उनमें से धब्बेदार टुकड़े को चुना जाता है ।
2. कुल सात धब्बेदार टुकड़ों में से एक धब्बेदार टुकड़े को चुना जाना आवश्यक है।
3. कुल इक्कीस टुकड़ों में से सात धब्बेदार हैं ।
4. टाट पर तीन समूह है जिनमें से एक धब्बेदार टुकड़ों का है ।
5. वर्गाकार टुकड़ों की संख्या का 3/4 तथा समचतुर्भुज टुकड़ों की संख्या का 4/9 धब्बेदार टुकड़े हैं ।

विषय : ९ :

चूहा

एक किसान ने अपने खेत में रहने वाले चूहों का अवलोकन किया । उसने पाया कि चूहे या तो मोटे अथवा पतले हैं । उसने यह भी पाया कि चूहों की पूंछ या तो काली अथवा सफेद है ।

इस अवलोकन ने उसे आश्चर्य में डाल दिया और सोचने लगा कि क्या चूहों के आकार तथा उनकी पूंछ के रंग में सम्बन्ध हो सकता है । अतः उसने उन सभी चूहों को पकड़ कर अपने खेत के एक हिस्से में रखकर अवलोकन करने का निर्णय लिया । उसने जिन चूहों को पकड़ कर रखा वे नीचे चित्र में दिखाये गये हैं ।

<u>क्या आप सोचते हैं कि चूहों के आकार तथा उनकी पूंछों के रंगों में कोई संबंध है? (अर्थात् एक विशिष्ट आकार वाले चूहों की एक विशिष्ट रंग की पूंछ होती है या उसके विपरीतक)।</u>

अ. हाँ

ब. नहीं

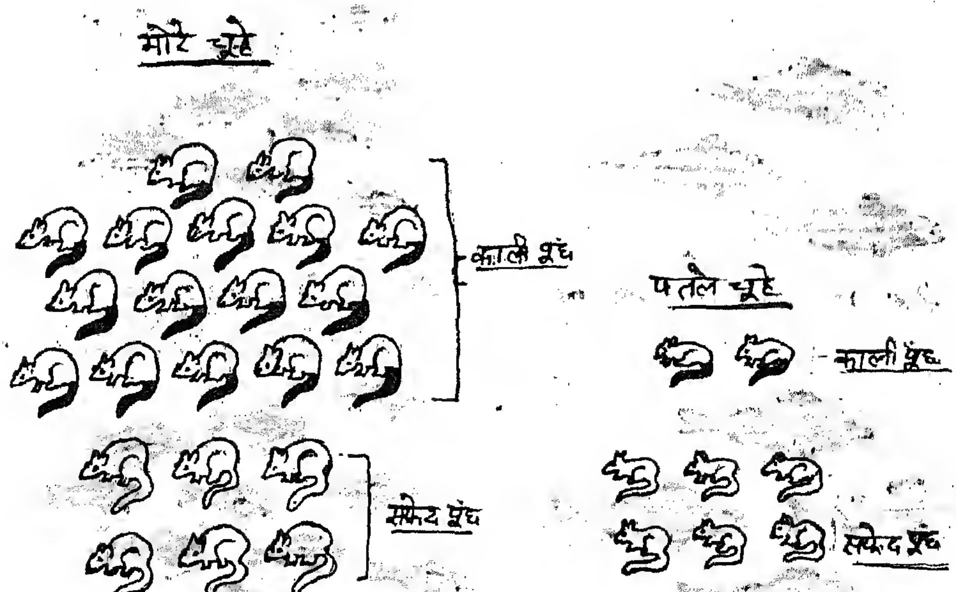
कारण: 1. मोटे चूहों की संख्या का 8/11 की और पतले चूहों की संख्या का 1/4 की काली पूंछ है ।

2. मोटे या पतले चूहे में से किसी के भी काली या सफेद पूंछ हो सकती है ।

3. न तो सभी मोटे चूहों की काली पूंछ है और न ही सभी पतले चूहों की सफेद पूंछ है ।

4. 18 चूहों की काली पूंछ तथा 12 चूहों की सफेद पूंछ है ।

5. 22 चूहे मोटे हैं तथा 8 चूहे पतले हैं ।



मछली

नीचे प्रदर्शित की गई मछलियों में कुछ बड़ी है तथा कुछ छोटी आकार की है। कुछ मछलियों की तह पर चौड़ी पट्टियाँ हैं तथा अन्य पर पतली पट्टियाँ।

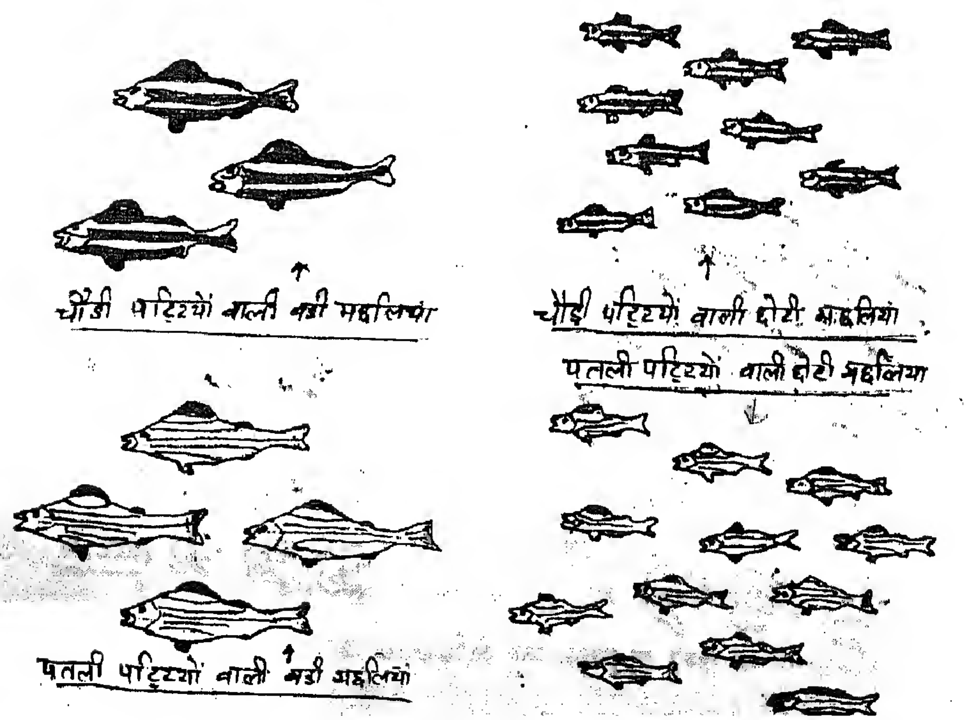
क्या मछलियों के आकार तथा पट्टियों के प्रकार में कोई सम्बन्ध है (अर्थात् एक विशिष्ट आकार की मछलियों में एक विशिष्ट प्रकार की पट्टियां पाई जाती हैं और इसके विपरीत)?

अ. हाँ

ब. नहीं

कारण/

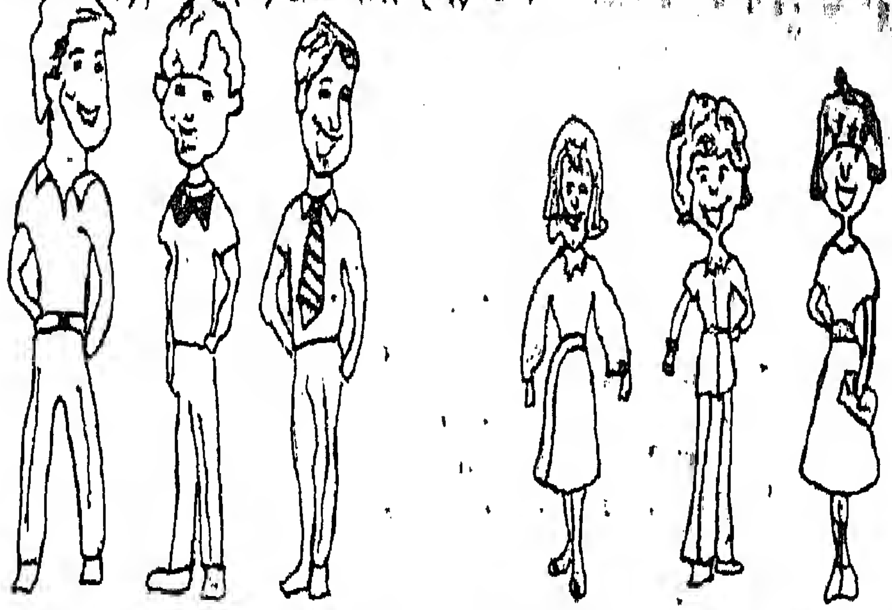
1. बड़ी और छोटी मछलियों में या तो चौड़ी अथवा पतली पट्टियाँ पाई जाती हैं।
2. बड़ी मछलियों की संख्या का 3/7 तथा छोटी मछलियों की संख्या का 9/21 में चौड़ी पट्टियाँ हैं।
3. 7 बड़ी मछलियाँ तथा 21 छोटी मछलियाँ हैं।
4. न तो सभी बड़ी मछलियों पर चौड़ी पट्टियाँ हैं और न ही सभी छोटी मछलियों पर पतली पट्टियाँ हैं।
5. कुछ मछलियों की संख्या का 12/28 पर चौड़ी पट्टियाँ तथा 16/28 पर पतली पट्टियां हैं।



विषय : 11

नाच

एक सांस्कृतिक संध्या पर कुछ विद्यार्थियों ने नाच करने का निर्णय लिया। इनमें तीन लड़के : अशोक(अ), बीरेन्द्र(ब) और सतीश(स) तथा तीन लड़कियाँ, रीता (र), लीला(ल) और मीना (म) हैं।



अशोक(अ) बीरेन्द(ब) सतीश(स) रीता(र) लीला(ल) मीना(म)

नाचने के लिए एक संभावित जोड़ा अर का है, इसका अर्थ है अशोक और रीता।

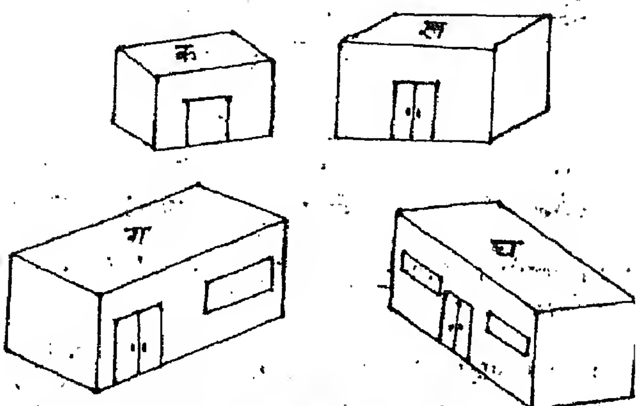
[illegible]

इसी प्रकार अन्य संभव जोड़ों को लिखिये। इसका ध्यान रखिये कि लड़का-लड़के के साथ तथा लड़की-लड़की के साथ नहीं नाच सकती है।

विषय : 12

<u>बाजार</u>

एक नये बाजार में चार दुकानों को आधार तल पर खोलना है जिसमें एक कालीन की दुकान (क), एक खिलौनों की (ख), एक गरम कपड़ों की, (ग) तथा एक घड़ी की दुकान (घ) को खोला जाना है।



बाजार में चारों दुकानों को खोले जाने का एक सम्भावित क्रम क, ख, ग, घ है अर्थात् सबसे पहले कालीन की दुकान, उसके बाद खिलौनों की दुकान, उसके बाद गरम कपड़ों की दुकान तथा सबसे बाद में घड़ी की दुकान।

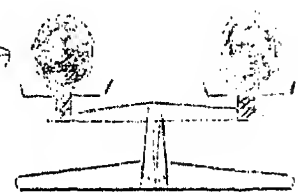
इसी प्रकार आप अन्य सम्भावित क्रमों को लिखिये जिनके द्वारा चारों दुकानों को खोला जा सकता है।

Item 1

Piece of Clay

Tom has two balls of clay. They are the size and shape. he places them on the balance, they weigh the same.

Clay 1 Clay 2

balance pan  balance pan

Balance

The balls of clay are removed from the balance pans. Clay 2 is flattened like a pancake.

Clay 1 Clay 2

WHICH OF THESE STATEMENTS IS TRUE ?

a. The pancake-shaped clay weighs more.

b. The two pieces weigh the same.

c. The ball weighs more.

REASON

1. You did not add or take away any clay.

2. When clay 2 was flattened like a pancake, it had a greater area.

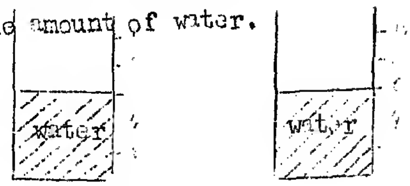
3. When something is flattened, it loses weight.

4. Because of its density, the round ball had more clay in it.

Item 2

Metal Weights

Linn has two jars. They are the same and shape. Each is filled with the same amount of water.

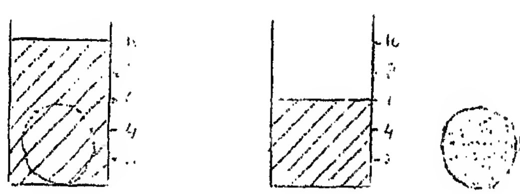


Jar 1 Jar 2

She also has two metal weights of the same volume. One weight is light. The other is heavy.

light metal weight heavy metal weight

She lowers the light weight into jar 1. The water level in the jar rises and looks loke this :



Jar 1 Jar 2 heavy metal weight

IF THE HEAVY WEIGHT IS LOWERED INTO JAR 2, WHAT WILL HAPPEN,

a. The water will rise to a higher level than in jar 1.

b. The water will rise to a lower level than in jar 1.

c. The water will rise to the same level as in jar 1.

REASON

1. The weights are the same size so they will take up equal amounts of space.

2. The heavier the metal weight, the higher the water will rise.

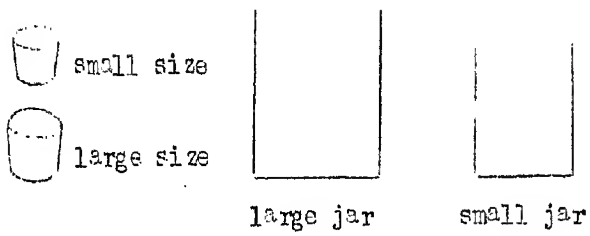
3. The heavy metal weight has more pressure, therefore, the water will rise lower.

4. The heavier the metal weight, the lower the water will rise.

Item 3

Class Size 2

The drawing shows two glasses, a small one and a large one. It also shows two jars, a small one and a large one.



It takes 15 small glasses of water or 9 large glasses of water to fill the large jar. It takes 10 small glasses of water to fill the small jar.

HOW MANY LARGE GLASSES OF WATER DOES IT TAKE TO FILL THE SAME SMALL JAR?

a. 4

b. 5

c. 6

d. other

REASON

1. It takes five less small glasses of water to fill the small jar. So it will take five less large glasses of water to fill the same jar.

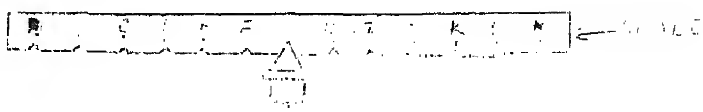
2. The ratio of small to large glasses will always be 5 to 3.

3. The small glass of half size of the large glass. So it will take about half the number of small glasses of water to fill up the same small jar.

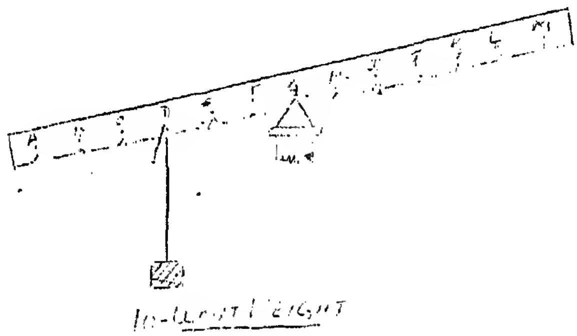
4. There is no way of predicting.

Scale 1

Dan has a scale like the one below.



When he hangs a 10-unit weight at point D, the scale looks like this :



WHERE WOULD HE HAND A 5-UNIT WEIGHT TO MAKE THE SCALE BALANCE AGAIN ?

a. at point J

b. between K and L

c. at point L

d. between L and M

e. at Point M

REASON

1. It is half the weight so it should be put at twice the distance.

2. The same distance as 10-unit weight, but in the opposite direction.

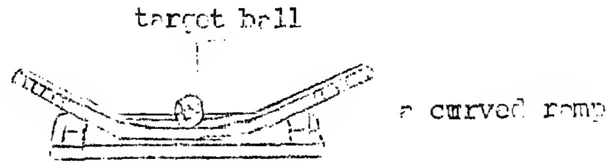
3. Hang the 5-unit weight further out, to make up its being smaller.

4. All the way at the end gives more power to make the scale balance.

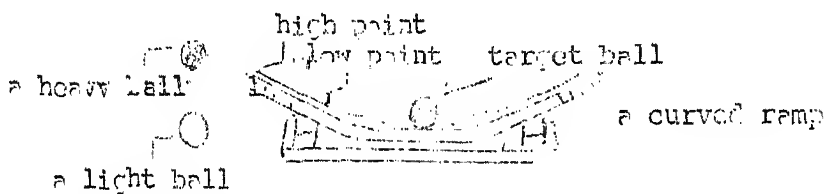
5. The lighter the weight, the further out it should be hung.

Ball 1

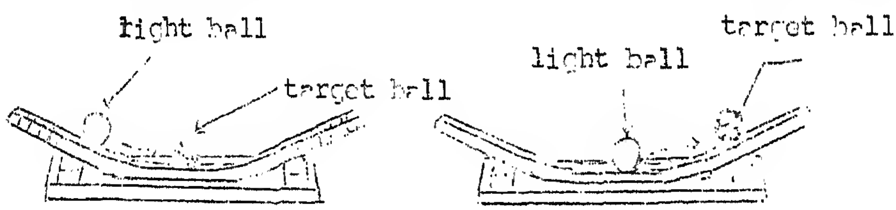
Eddie has a curved ramp. At the bottom of the ramp there is one ball called the target ball.



There are two other balls, a heavy and a light one. He can roll one ball down the ramp and hit the target ball. This causes the target ball to move up the other side of the ramp. He can roll the balls from two different points, a low point and a high point.



Eddie released the light ball from the low point. It rolled down the ramp. It hit and pushed the target ball up the other side of the ramp.



He wants to find out if the point a ball is released from makes a difference in how far the target goes. TO TEST THIS WHICH BALL WOULD HE NOW RELEASE FROM THE HIGH POINT ?

a. the heavy ball
b. the light ball

REASON

1. He started with the light ball he should finish with it.

2. He used the light ball the first time. The next time he should use the heavy ball.

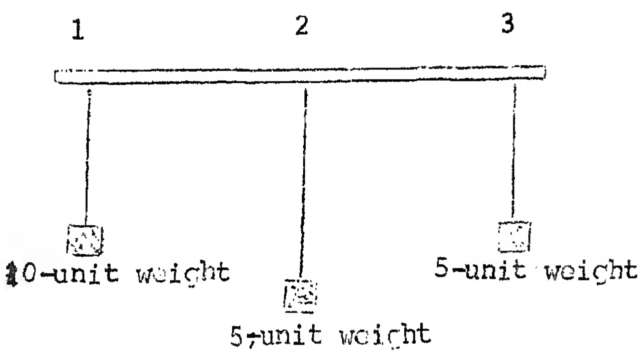
3. The heavy ball would has moreforce to hit the target ball farther.

4. The light ball would have to be released from the high point in order to make a fair comparison.

5. The same ball must be used as the weight of the ball does not count.

Pendulum Length

Three strings are hung from a bar. String 1 and 3 are of equal length. String 2 is longer. Charlie attaches a 5-unit weight at the end of string 2 and at the end of 3. A 10-unit weight is attached at the end of string 1. Each string with a weight can be swung.



Charlie wants to find out if the length of the string has an effect on the amount of time it takes the string to swing back and forth.

WHICH STRING AND WEIGHT WOULD HE USE FOR HIS EXPERIMENT ?

a. string 1 and 2

b. string 1 and 3

c. string 2 and 3

d. string 1, 2, and 3

e. string 2 only

REASON

1. The length of the strings should be the same. The weights should be different.

2. Different lengths with different weights should be tested.

3. All strings and their weights should be tested against all others.

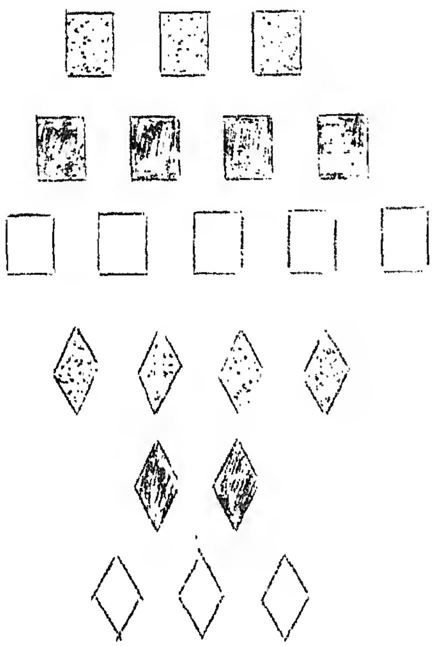
4. Only the longest string should be tested. The experiment is concerned with length not weight.

5. Everything needs to be the same except the length so you can tell if length makes a difference.

Item 8

Squares and Diamonds - 2

In a cloth sack, there are



3 spotted wooden squares

4 black wooden squares

5 white wooden squares

4 spotted wooden diamonds

2 black wooden diamonds

3 white wooden diamonds

All of the square pieces are the same size and shape. The diamond pieces are also the same size and shape. Reach in and take the first piece you touch. WHAT ARE THE CHANCES OF PULLING OUT A SPOTTED DIAMOND OR A WHITE DIAMOND ?

a. 1 out of 3

b. 1 out of 9

c. 1 out of 21

d. 9 out of 21

e. other

REASON

1. Seven of the twenty-one pieces are spotted or white diamonds.

2. 4/7 of the spotted and 3/8 of the white are diamonds.

3. Nine of the twenth-one pieces are diamonds.

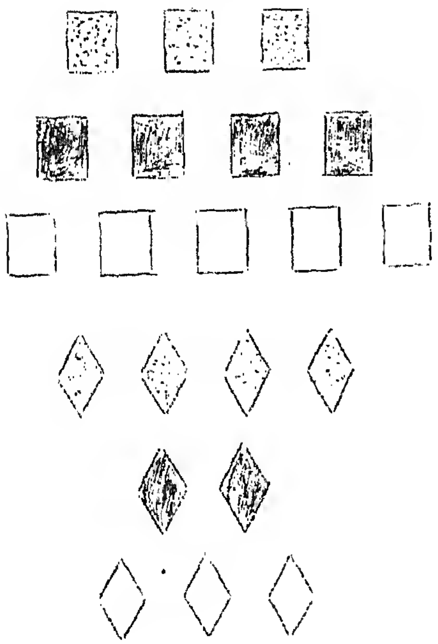
4. One diamond piece needs to be selected from a total of twenty-one pieces in the cloth sack.

5. There are 9 diamond pieces in the cloth sack. One piece must be chosen from these.

Item 7

Squares and Diamonds - 1

In a cloth sack, there are



3 spotted wooden squares

4 black wooden squares

5 white wooden squares

4 spotted wooden diamonds

2 black wooden diamonds

3 white wooden diamonds

All of the square pieces are the same size and shape. The diamond pieces are also the same size and shape. One piece is pulled out of the sack. WHAT ARE THE CHANCES THAT IT IS A SPOTTED PIECE ?

a. 1 out of 3

b. 1 out of 4

c. 1 out of 7

d. 1 out of 21

e. other

REASON

1. There are twenty-one pieces in the cloth sack. One spotted piece must be chosen from these.

2. One spotted piece needs to be selected from a total of seven spotted pieces.

3. Seven of the twenty-one pieces are spotted pieces.

4. There are three sets in the cloth sack. One of them is spotted.

5. 1/4 of the square pieces and 4/9 of the diamond pieces are spotted.

Item 10

The Fish

Some of the fish below are big and some are small. Also some of the fish have wide stripes on their sides. Others have narrow stripes. IS THERE A RELATIONSHIP BETWEEN THE SIZE OF THE FISH AND THE KIND OF STRIPES IT HAS (THAT IS, IS ONE SIZE OF FISH MORE LIKELY TO HAVE A CERTAIN TYPE OF STRIPES AND VICE VERSA)?

a. Yes
b. No

REASON

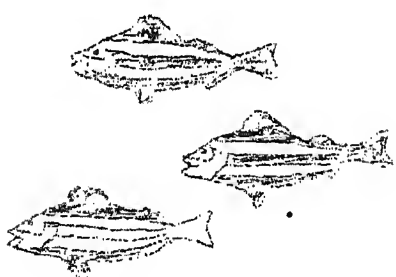
1. Big and small fish can have either wide or narrow stripes.

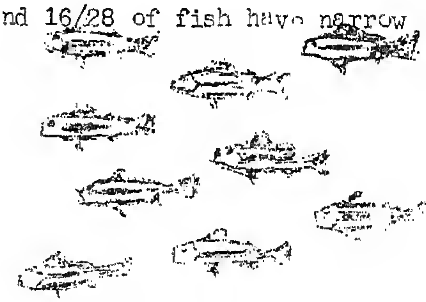
2. 3/7 of the big fish and 9/21 of the small fish have wide stripes

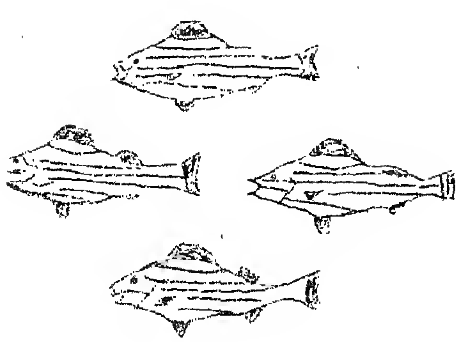
3. 7 fish are big and 21 are small.

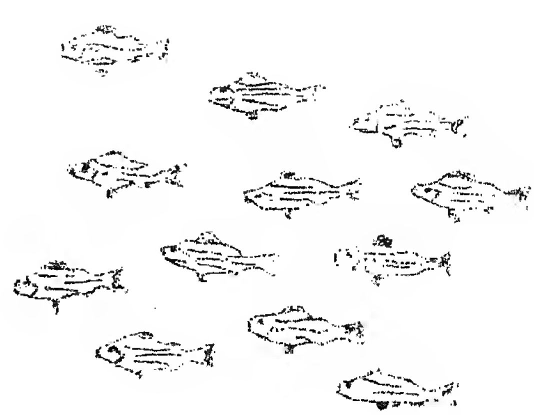
4. Not all big fish have wide stripes and not all small fish have narrow stripes.

5. 12/28 of fish have wide stripes and 16/28 of fish have narrow stripes.









Item 9

The Mice

A farmer observed the mice that live in his field. He found that the mice were either fat or thin. Also, the mice had either black tails or white tails.

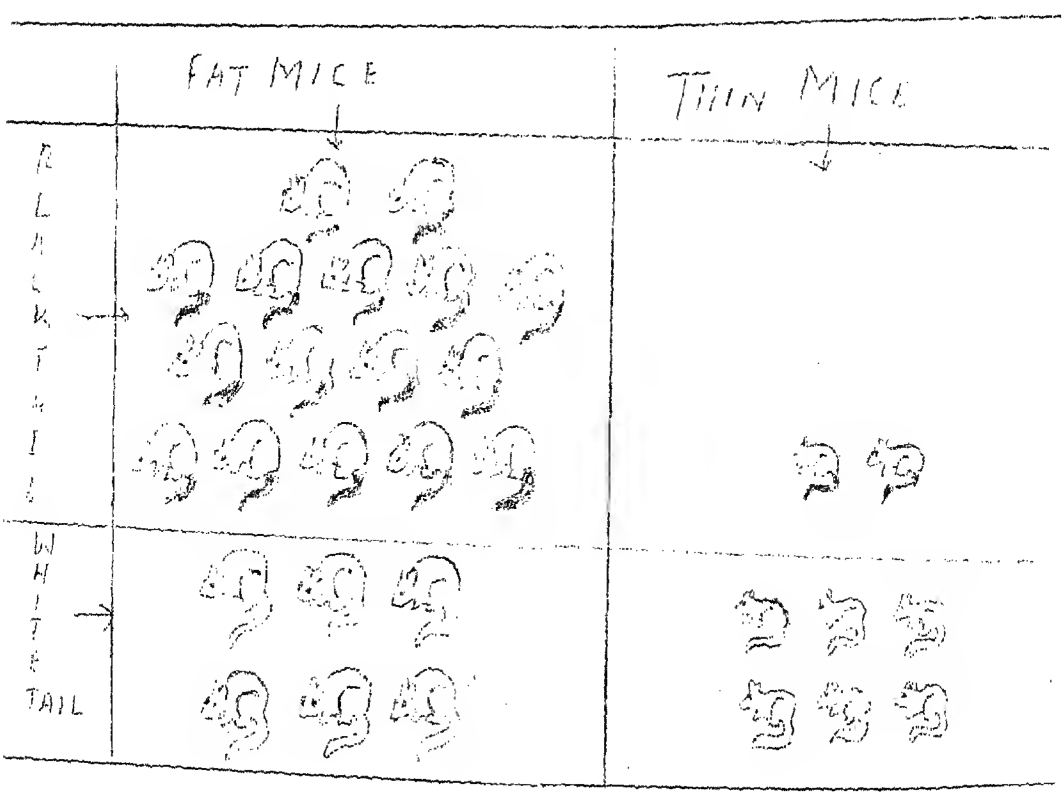
This made him wonder if there might be a relation between the size of a mouse and the color of its tail. So he decided to capture all of the mice in one part of his field and observe them. The mice that he captured are shown below.

DO YOU THINK THERE IS A RELATION BETWEEN THE SIZE OF THE MICE AND THE COLOR OF THEIR TAILS (THAT IS, IS ONE SIZE OF MOUSE MORE LIKELY TO HAVE A CERTAIN COLOR TAIL AND VICE VERSA)?

a. Yes
b. No

REASON

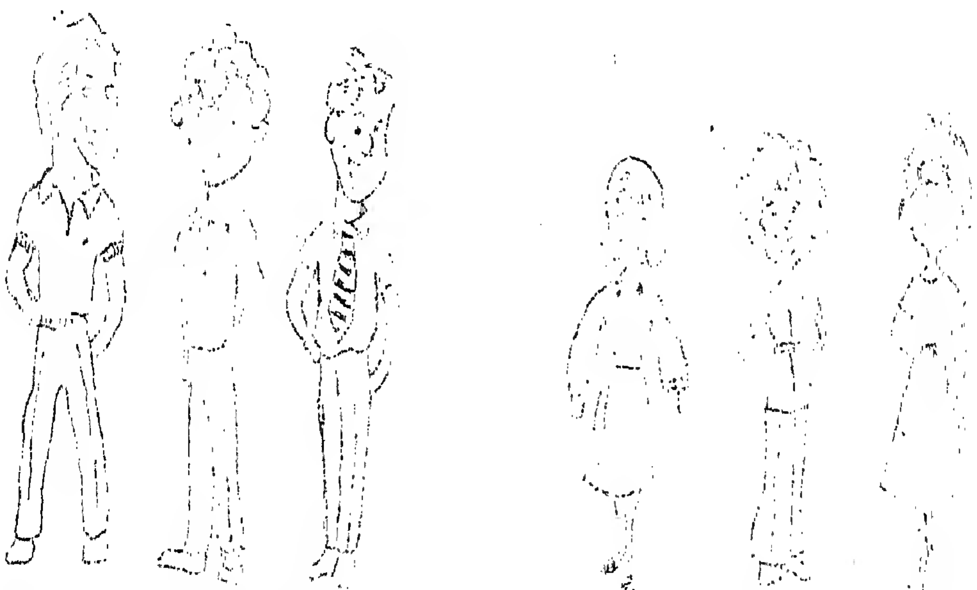
1. 8/11 of the fat mice have black tails and 3/4 of the thin mice have white tails.
2. Fat and thin mice can have either a black or a white tail.
3. Not all far mice have black tails. Not all thin mice have white tails.
4. 18 mice have black tails and 12 have white tails.
5. 22 mice are fat and 8 mice are thin.



Item 11

The Dance

After supper, some students decide to go dancing. There are three boys: Ashok (A), Birendra (B), and Cand (C), and three girls: Lile (L), Meena (M), and Neena (N).



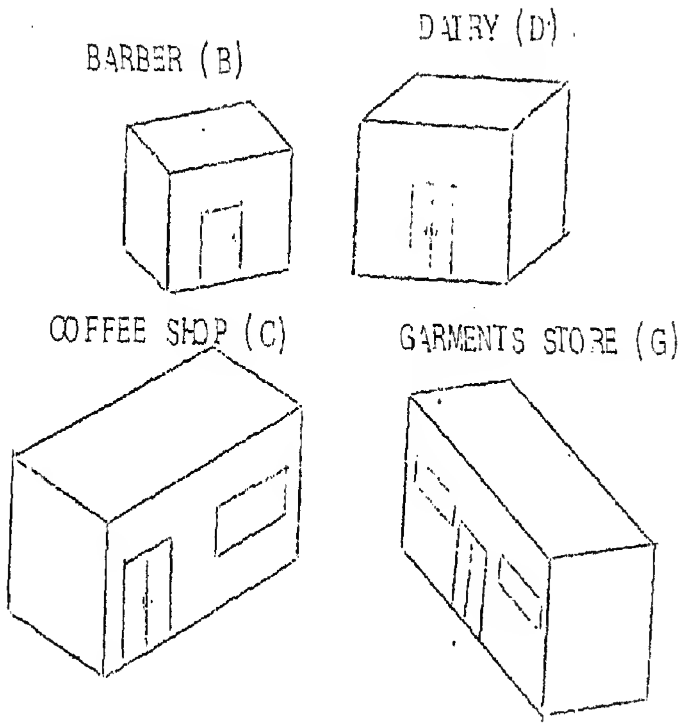
One possible pair of dance partners is A-L, which means Ashok and Leela.

LIST ALL OTHER POSSIBLE COUPLES OF DANCERS. BOYS DO NOT DANCE WITH BOYS, AND GIRLS DO NOT DANCE WITH GIRLS.

Item 12.

The Shopping Center

In a new shopping center, 4 storesare going to be placed on the ground floor. A BARBER SHOP (B), a DAIRY (D), a GARMENTS STORE (G), and a COFFEE SHOP (C) want to locate there.



One possible way that the stores could be arranged in the 4 locations is BDGC. Which means the BARBER SHOP first, the DAIRY next, then the GARMENTS STORE and the COFFEE SHOP last.

LIST ALL THE OTHER POSSIBLE WAYS THAT THE STORES CAN BE LINED UP IN THE FOUR LOCATIONS.

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XXMGEN  EXEC  PGM=IEBGENER                                                   00000200
XXSTEPLIB   DD  DSN=SIMPUT,DISP=SHR                                          00000250
XXSYSIN  DD  DUMMY                                                           00000300
XXSYSPRINT  DD  SYSOUT=A                                                     00000400
XXSYSUT1    DD  UNIT=&U,VOL=SER=&IV,DISP=(OLD,PASS),DSN=&D,                  00000500
IEF653I SUBSTITUTION JCL - UNIT=2400,VOL=SER=INTAP,DISP=(OLD,PASS),DSN=NAME,
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10242212511415000609050210080206030004020003010701010200100000001005349225
10252211413112000911040103020006050006010004010400000100000000001004552222
10262211616115000906050309040411060110040008010601010110000000000004849231

TABLE : 1

SHOWING MEAN AND SD ON TEST OF CREATIVITY ACHIEVEMENT AND SOCIO-ECONOMIC STATUS FOR VARIOUS GROUPS OF STUDENTS

	POPULATION(N=1026)		URBAN(N=892)		RURAL(N=134)		BOYS(N=656)		GIRLS(370)		GOVERNMENT (654)		AIDED(372)		GENERAL(942)		SC/ST (N=84)	
NV Fl	99.65	17.34	100.75	16.92	92.40	18.27	97.75	18.02	103.06	15.31	99.34	16.50	100.24	18.60	100.04	17.03	95.36	20.03
NV Fx	100.29	16.84	102.16	16.13	87.89	16.05	99.85	17.06	101.12	16.25	100.23	16.13	100.44	17.07	100.77	16.62	94.95	18.22
NV Or	99.34	17.25	100.74	17.60	90.02	10.56	98.94	18.31	100.07	14.97	98.48	15.70	100.88	19.46	99.92	17.56	92.78	11.12
Tot. NV	299.30	44.95	303.66	44.11	270.32	39.40	296.52	46.65	304.29	41.39	298.03	41.81	39.55	49.91	300.75	44.82	283.10	43.37
V Fl	202.20	32.67	204.19	33.41	189.00	23.31	194.30	31.73	216.25	29.44	199.11	31.06	207.66	34.66	203.28	32.92	190.20	27.06
V Fx	151.51	22.31	153.62	22.04	137.54	18.76	150.00	22.67	154.22	21.36	151.19	21.67	152.10	28.36	152.75	22.30	144.33	21.22
V Or	208.92	32.11	211.58	32.18	180.37	21.09	203.68	30.82	216.48	32.71	205.84	31.24	212.62	33.13	209.37	32.64	196.19	21.98
Total V	562.04	78.85	569.42	79.30	512.91	54.03	548.00	77.36	586.94	75.17	555.16	75.35	572.30	84.15	564.83	79.29	530.73	60.06
Fl	301.87	44.25	304.94	44.73	281.41	34.50	292.04	43.37	319.30	40.22	298.45	41.31	307.90	68.39	303.32	44.29	285.57	40.39
Fx	251.81	33.98	255.78	32.68	225.43	30.47	249.84	34.53	255.33	32.66	251.41	32.19	252.34	36.89	252.92	33.72	239.29	34.46
Or	307.64	44.74	312.33	44.87	276.39	28.20	302.62	44.48	316.55	43.79	304.31	41.80	313.49	48.92	309.30	45.53	288.98	28.56
Tot. Cre.	861.36	112.12	873.10	111.38	783.22	82.47	844.54	111.48	891.19	107.80	854.21	103.91	873.94	124.82	865.60	112.89	813.83	91.21
FE	5.61	1.31	5.05	1.12	4.28	1.62	5.34	1.42	6.12	0.89	5.63	1.32	5.69	1.28	5.74	1.23	4.65	1.65
ME	3.91	1.96	4.22	1.85	1.87	1.39	3.48	1.99	4.67	1.64	3.79	1.98	4.11	1.89	4.06	1.92	2.26	1.64
FO	5.40	1.30	5.56	1.19	4.29	1.47	5.21	1.34	5.73	1.15	5.33	1.33	5.52	1.23	5.47	1.26	4.63	1.48
MO	1.72	1.71	1.80	1.79	1.18	0.86	1.62	1.59	1.91	1.80	1.73	1.70	1.71	1.71	1.77	1.75	1.17	0.903
PI	2234.37	1131.37	2359.32	1140.30	1402.61	594.72	2096.13	1151.71	2479.46	1052.94	2205.98	1088.49	2284.27	1203.70	2287.70	1141.97	1636.31	793.36
FS	5.69	1.43	5.52	1.33	6.77	1.59	5.75	1.47	5.59	1.35	5.69	1.42	5.68	1.44	5.62	1.40	6.45	1.516
Math	63.43	13.00	64.42	13.80	56.81	10.93	64.18	13.00	62.09	12.90	61.49	12.67	66.83	12.89	63.75	13.04	59.84	12.08
Science	59.93	11.15	60.74	11.29	54.54	8.35	59.98	11.44	59.83	10.63	58.32	10.99	62.75	10.89	60.23	11.13	56.51	10.84
Agg.	292.20	53.01	296.44	53.50	263.94	30.75	295.24	53.66	206.81	51.49	284.89	50.11	305.05	55.55	293.76	53.18	274.64	48.01

TABLE :2

	TOTAL POPULATION (N =)						URBAN (N =)						RURAL (N =)					
	CONCRETE		TRANSITIONAL		P FORMAL		CONCRETE		TRANSITIONAL		FORMAL		CONCRETE		TRANSITIONAL		FORMAL	
	N=263		N=518		N=245		N=210		N=449		N=233		mN=53		N=69		N=12	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
NV.FL	92.57	18.48	99.06	16.19	108.55	14.08	93.65	18.41	99.67	15.83	109.26	13.56	88.29	18.31	95.13	18.06	94.84	17.39
NV.FX	91.90	16.38	99.51	15 24	111.01	14.46	94.41	15.89	199.71	14.85	111.97	13.60	81.92	14.52	91.71	15.56	92.28	18.32
NV.OR.	86.97	8.50	97.51	13.33	116.53	17.83	88.04	0.49	98.02	13.84	117.47	17.53	82.73	7.20	94.18	8.68	98.35	13.95
T/NV.	271.44	38.10	296.07	37.92	336.09	40.74	286.11	37.46	298.38	37.36	338.70	38.95	252.95	35.11	281.02	37.43	285.48	43.08
V.FL	184.21	24.53	199.75	28.61	226.76	33.56	184.14	25.12	201.18	29.17	228.12	33.31	184.45	22.26	190.53	22.73	290.38	27.86
V.LX	138.16	18.97	149.85	19.46	169.43	19.29	140.31	19.11	151.09	19.27	170.68	18.52	129.62	15.91	742.32	18.97	144.99	18.17
V.OR	182.73	17.55	204.97	23.40	242.79	30.11	185.18	17.34	207.01	23.38	244.25	29.93	173.03	14.51	191.72	18.84	214.49	17.02
TOT.V	505.08	52.00	554.58	61.82	638.97	75.13	509.63	52.91	559.19	61.80	643.05	73.71	487.11	43.95	524.57	52.98	559.86	58.39
FL	276.77	36.16	298.81	38.46	335.31	42.95	277.79	36.90	300.84	38.70	337.38	42.28	282.75	33.05	285.66	34.09	295.22	36.83
FX	230.06	30.33	249.35	28.55	280.44	27.82	234.73	29.31	251.71	27.74	282.66	25.84	211.54	27.29	234.03	29.08	237.28	30.53
OR	269.71	21.07	302.47	29.36	359.32	42.35	273.21	20.47	305.02	29;33	361.72	41.66	255.76	17.41	285.89	23.53	312;85	26.20
T.CRET.	776.53	76.84	850.60	83.92	975.07	103.85	785.74	76.42	857.59	82.88	981.75	100.41	740.06	67.35	805.59	177.42	845.35	85.09
FE	5.24	1.49	5.57	1.28	6.26	0.89	5.52	1.30	5.77	1.07	06.32	0.85	4.11	1-70	4.24	1.57	5.25	1.21
ME	3.20	1.88	3.79	1.93	4.92	1.68	3.51	1.86	4.11	1.81	5.06	1.57	1.98	1.43	1.74	1.37	2.16	1.33
FO	5.05	1.34	5.28	1.25	6.03	1.14	5.32	1.11	5.41	1.17	6.08	1.84	3.98	1.61	4.39	1.40	5.08	0.67
MO	1.36	1.25	1.52	1.47	2.54	2.26	1.37	1.28	1.58	1;55	2.62	2.29	1-28	1.11	1.13	0.70	1.00	0.00
PE	1724.52	761.36	2090.56	894.41	3085.71	1417.92	1818.81	762.46	2193.89	888.00	3165.23	1406.99	1350.94	637.19	1418.11	598.16	1541.66	331.54
PS	5.95	1.44	51.77	1.42	5.26	1.36	5.72	1.33	5.61	1.31	5.18	1.29	6.73	1.57	6.81	1.61	6.75	1.71
MATH	51.30	9.31	63.72	9.78	75;83	10.03	51.74	9.71	64.31	9.67	76.06	10.08	49.55	7.35	59.87	9.70	71.33	8.05
SERVICE	50.01	7.59	59.35	8.36	71.80	7.99	50.10	8.25	59.82	8.25	72.09	7.95	49.66	4.05	56.27	8.46	66.08	6.67
T.ACH.	238.82	31.99	292.83	35.36	348.16	42.95	239.52	33.24	295.13	35.02	350.28	42.65	236.04	26.59	277.90	34.17	306.91	24.58

Appendix - XI

Coefficients of Correlation (GALT)

	Test	'r'
1.	Conservation	0.57^{xxx}
2.	Proportional Reasoning	0.45^{xx}
3.	Controlling Variable	0.66^{xx}
4.	Probabilistic Reasoning	0.50^{xx}
5.	Correlational Reasoning	0.78^{xxx}
6.	Combinational Reasoning	0.88^{xxx}
	Total	0.71^{xxx}

xx - $p < .01$
xxx - $p < .001$